IN THIS ISSUE

- The cataracts at the mouth of the River Erne in Eire, previously of commercial importance only for the salmon they yield, are being harnessed to increase the nation's supply of electricity. V. D. Harty, chief engineer for the contractor in charge, describes the work in our first article.
- Desert ice caves, one of nature's paradoxes, are discussed (Page 7) by Dr. E. R. Harrington, who has studied these phenomena for several years.
- The building of ingenious scale models of rock-drilling machinery is a hobby of K. A. Chubb, a British engineer, who has put them to practical use (Page 10).
- Some relief for New York's harassed subway riders is promised by lengthening the local-station platforms on older sections of the world's greatest underground railway (Page 12).
- Deficiencies of machines designed to test the blow energy of rock drills are discussed by J. D. Ditson, who offers a mathematical formula that is claimed to give reasonably accurate results (Page 15).

•

THE "HOT-COLD" TUBE

EDITOR:

In your August, 1946, issue, page 206, Mr. P.A. Baumeister says that there is no mystery in the tube described in the May issue, page 131. This tube, which has no moving parts, produces two streams of air—one hot and one cold—when supplied with a single stream of compressed air. Baumeister's explanations refer to two well-known phenomena, first the cooling of air on expansion as calculated by thermodynamics and, second, the Joule-Thompson effect. In saying that these well-known phenomena explain quantitatively the measurements observed he has apparently not taken the trouble to ascertain the facts. Hilsch did apparently report temperatures measured on the wall of a tube where the gas was moving at high velocity. We have measured them there, but also measured temperatures after the gas has passed through pipes and a measuring orifice with the whirl dissipated and the gas at low velocity, and yet we measure approximately the same low temperature.

The only effect remaining in Baumeister's explanation is then the Joule-Thompson cooling. From the International Critical Tables, Vol. V, p. 144, Fiist Edition, McGraw-Hill Book Co., the Joule-Thompson coefficient is .218°C. per atmosphere at 3 atm.* and 30°C $\left(\frac{\partial T}{\partial P}\text{ being positive}\right)$.

In one case which we have studied, expanding from 4 atm. absolute to 1 atm. absolute, the compressed gas enters at 28.5°C. and leaves at 0°C., or a cooling of 28.5°C., whereas the Joule-Thompson cooling would be only .218 x 3 = .654°C. So I think that when we compare this .654°C. calculated from Joule-Thompson effect with the 28.5°C. obtained experimentally and measured where the velocity is low, we have to agree that there are still important unknowns which I think the reporter was justified in calling a "mystery."

G. W. PENNEY

Westinghouse Electric Corporation,
Pittsburgh, Pa.

*This value of .218 was obtained by interpolating between values for 1 atm. and 20 atm. at 0 C and 50°C., the maximum value in this interpolation being .266 and the minimum .178.

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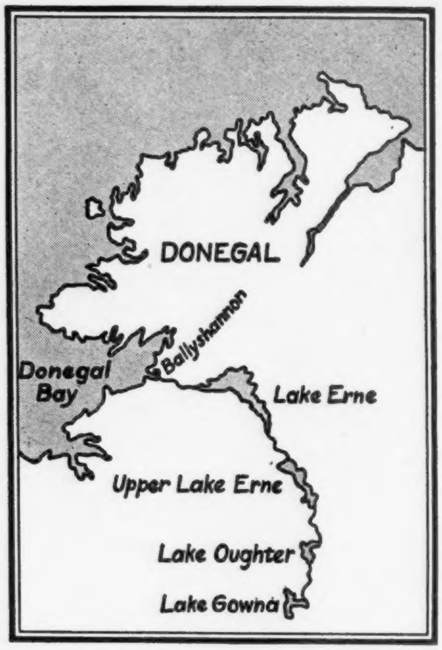
River Erne Power Development

V. D. Harty



LOCATION MAP
The 70-mile-long River Erne, which has several lakes in its course, empties into Donegal Bay in the highlands of northwestern Eire. Facilities for generating power are being built just upstream from the town of Ballyshannon.

Two Dams in Northern Eire Will Increase Country's Hydroelectric Generating Capacity by One-Third.

TODAY, Eire depends for its electricity on two waterpower stations on the rivers Shannon and Liffey and on a number of steam plants with a combined installed capacity of 268,000 kva. In 1946, the total consumption was close to 600 million units, of which two-thirds was generated by the hydroelectric stations. To meet the rapidly increasing demand for electric energy, the Electricity Supply Board has included in its postwar program the development of the River Erne in the northern part of the country.

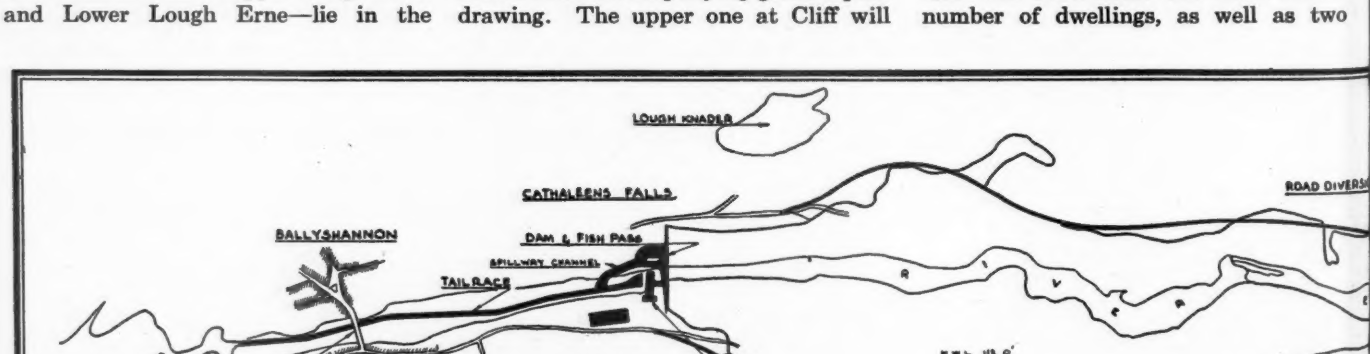
The Erne rises 25 miles from the east coast of Eire and flows northward and westward to drain some 1500 square miles before emptying into the Atlantic Ocean or, properly, Donegal Bay. It has an average flow of 3900 second-feet and a flood discharge of 11,000 second-feet. Two natural lakes—Upper Lough Erne and Lower Lough Erne—lie in the course of the river. The latter lake is at present controlled for drainage purposes by sluices.

From the sluices to the sea is a distance of 4 miles in which the river falls about 140 feet, constituting a source of energy that is now being harnessed. Within this stretch are cascades where the trapping of salmon has long been one of the principal industries of the section. In the past, much of the catch has been exported to England. Fishing is also conducted in the sheltered waters along the coast of Donegal Bay. Surrounding areas are mountainous, and only limited agricultural development is possible. The trading center is Ballyshannon, a town of some 2500 persons located at the mouth of the river.

The project underway will utilize the 140-foot drop in two steps, which are shown in an accompanying general plan drawing. The upper one at Cliff will have a head of 40 feet. It will involve the construction of a gravity dam with a height of 60 feet, a length of 600 feet, and containing 30,000 cubic yards of concrete. The power station is being built right into the dam and will house two Kaplan turbines coupled to 12,500-kva. generators. Flood discharge will be regulated by three electrically operated crest gates 20 feet wide by 31 feet 8 inches high. These gates will replace the sluices of Lower Lough Erne when the undertaking is completed. The partial development now in progress will use a lower water level that will not affect the present lake control.

The lower development is at Cathaleen's Falls half a mile from the sea, and will consist of a straight gravity dam with three crest gates 36 feet wide by 15 feet high. The structure will rise to a height of 90 feet, will be 1000 feet long, and will call for the use of 75,000 cubic yards of concrete. The fall available there will be 100 feet, and the power plant will contain two 25,000-kva. generators connected to Kaplan turbines. Provision has been made for the installation of a third set at a later date.

The turbines will discharge into a tailrace, 50 feet wide and 25 feet deep, which is being excavated in rock in the river bed for a distance of ½ mile from Cathaleen's Falls Dam to the tidal estuary. The reservoir to be formed by the dam will flood some 900 acres and a number of dwellings, as well as two



PHOTO, IRISH PRESS

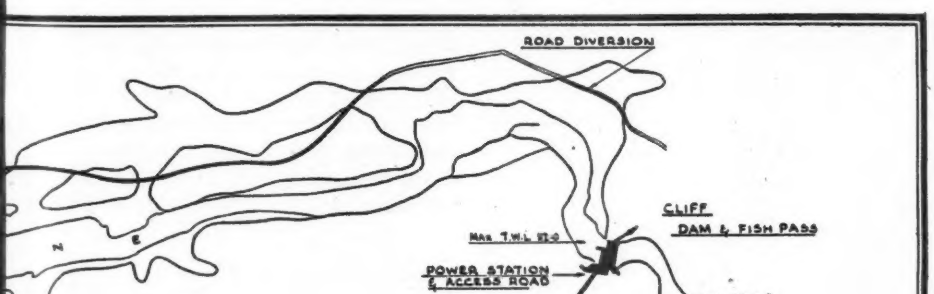
AERIAL VIEW, CATHALEEN'S FALLS DAM AREA

The river is shown diverted through a temporary channel at the right, while the stream bed has been cofferdammed above and below the dam site so that excavating for the foundation can be carried on in the dry. A steel construction bridge just downstream of the dam line has been partially erected. On either side of the diversion channel have been placed blocks of concrete housing culverts through which the river will flow while the final sections are being poured to close the dam. The culverts will then be sealed with roller gates. The aggregate and concrete-mixing plants are in the center foreground. Housing for the staff and workers is in the left background.

roads. It is therefore necessary to build several miles of new highways to take the traffic of those that will be submerged. In addition, an earth dam 3000 feet long and 26 feet high is being reared to protect an adjoining railway on low-lying land.

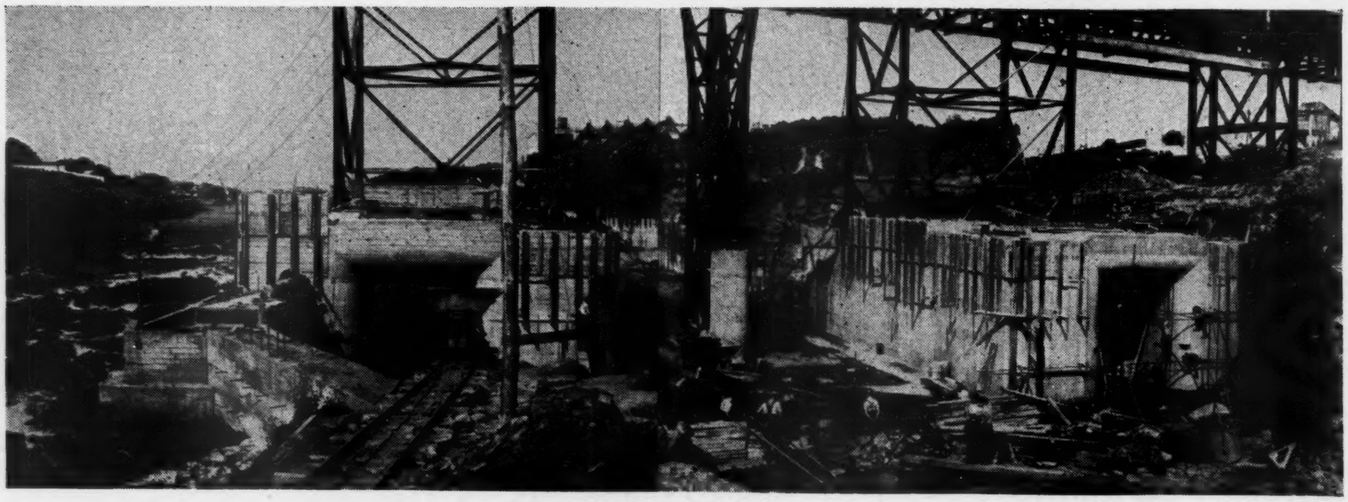
The contractors on the project, The Cementation Company, Ltd., Doncaster, England, began work in February, 1946, with the erection at Cathaleen's Falls of plant and buildings, staff bungalows, and a camp to house up to 500 men. Electric power from the Electricity Supply Board network has been brought to all major construction sites, and air for drilling and other services is provided by one ES-1 single-stage and twelve Type 40 Ingersoll-Rand machines with a total capacity of 5000 cfm. They are installed in a central compressor house from which mains up to 6 inches in diameter deliver the air to all points of application, including the upper development at Cliff.

All building sites are supplied with concrete from a central mixing plant, also situated at Cathaleen's Falls. There are two 1-cubic-yard mixers, each with an output of 25 cubic yards an hour and with its own set of bins and batch conveyor. Limestone taken from the excavations is used as aggregate and is reduced in a plant consisting of two 30x18-inch jaw crushers feeding over scalping screens to a secondary breaker.



GENERAL PLAN OF DEVELOPMENT

In the final 4 miles of its flow, just before it enters the Atlantic Ocean, the River Erne drops 140 feet, and this fall will be utilized to develop power in two steps. Total generating capacity under the present development will be 75,000 kva., or more than half as much as the country's existing hydroelectric capacity (138,000 kva.), all of which is on the rivers Shannon and Liffey. The total installed capacity of the country's steam plants is 130,000 kva. The project is being carried out by the Electricity Supply Board to meet Eire's need for additional electricity.



DIVERSION CULVERTS

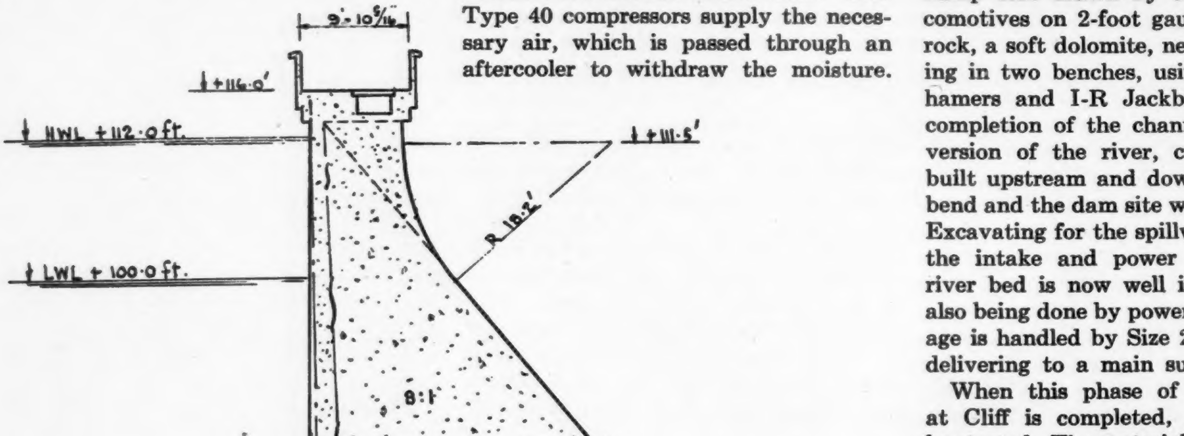
Close view of the two concrete culverts, each with openings 15 feet high and 12 feet wide, poured in advance to carry the stream through Cathaleen's Falls Dam while the final closure is being made. The river, seen in its natural channel at the left, was afterward diverted to run between these blocks to permit rearing the dam across the stream bed. Steel bents of the construction bridge erected just downstream of the dam line are shown in place.

From there the product goes to two 3-deck screens which give the following finished sizes: 0-3/16 inch, 3/16-¾, ¾-1½, and 1½-3 inches. The material is transported by conveyor to two sets of steel storage bins each with a capacity of 500 tons. Sand produced in the process is passed through a dewaterer.

A belt traveling in a tunnel under each set of bins feeds the aggregate to the batch hoist of each mixer. The material is deposited on the conveyor by volume, or weight in the case of sand, by operating air rams from a control panel, thus opening and closing hopper valves in the base of the bins and batch measurers. Cement is delivered in bulk by rail in 10-ton cars, and is blown at the rate of 12 tons per hour into two 300-ton silos by a 50-cubic-foot Robinson activator. Two Type 40 compressors supply the necessary air, which is passed through an aftercooler to withdraw the moisture. From the silos, which are in line with the aggregate bins, weighed cement is fed into the batch hoists.

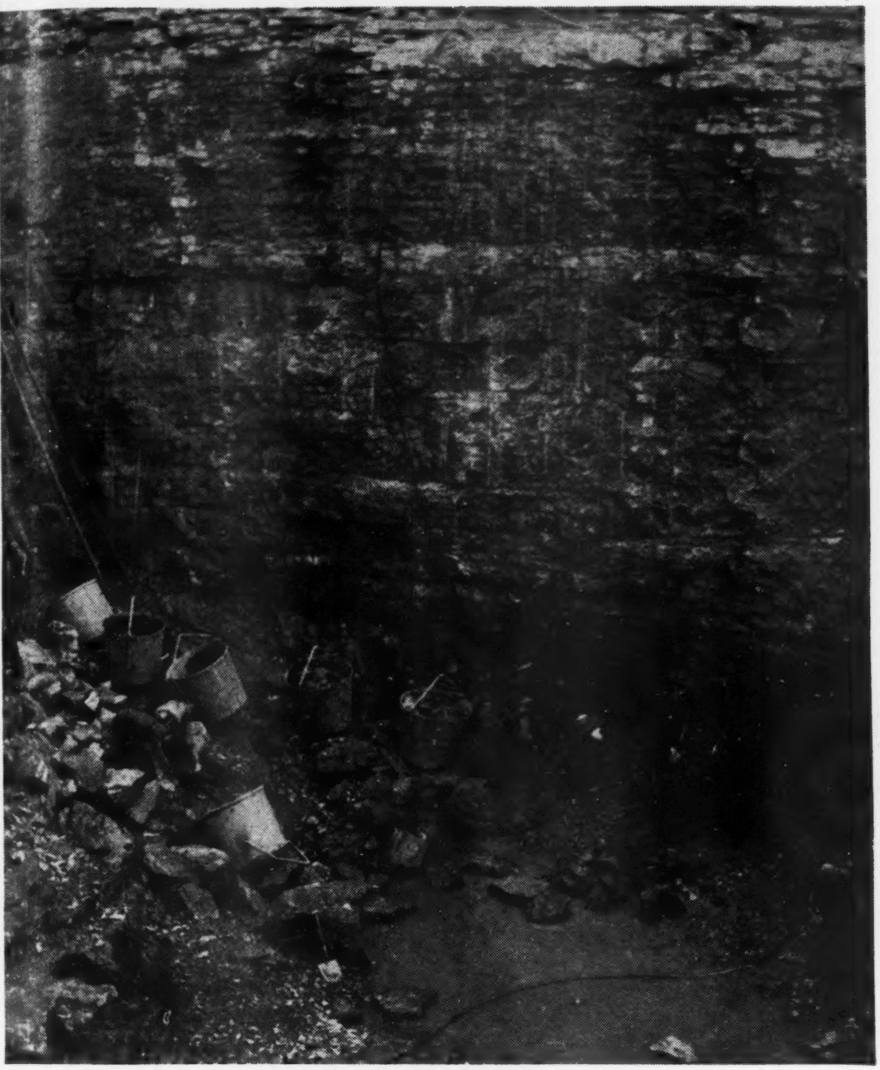
The site of the dam at Cliff is at a bend in the Erne where a channel, 50 feet wide and 25 feet deep, has been excavated through a rock spur to divert the river. This work was carried out with two 17 Ruston-Bucyrus power shovels loading into 1⅓-cubic-yard side-dump cars drawn by 30-hp. diesel locomotives on 2-foot gauge track. The rock, a soft dolomite, necessitated drilling in two benches, using JA-45 Jackhamers and I-R Jackbits. With the completion of the channel and the diversion of the river, cofferdams were built upstream and downstream of the bend and the dam site was pumped dry. Excavating for the spillway section and the intake and power station in the river bed is now well in hand, and is also being done by power shovels. Seepage is handled by Size 25 sump pumps delivering to a main sump.

When this phase of the operations at Cliff is completed, concreting will be started. The material will be brought from the central mixing plant at Cathaleen's Falls by 4-cubic-yard tipping trucks that will discharge into a hopper feeding a 2½-cubic-yard remixer. From there it will be transported in 1-yard Blaw-Knox bottom-dump skips to be handled at the pouring sites by 5-ton fixed derrick cranes. Model 2V and



SECTION THROUGH CATHALEEN'S FALLS DAM

This straight gravity-type concrete structure will be 1000 feet long and 90 feet high, with a basal thickness of about 73 feet.



LINE-HOLE DRILLING
Finished face of a section of the tailrace side walls, all of which were drilled with closely spaced holes to insure a smooth and regular surface.

3V Ingersoll-Rand vibrators will be used to compact the placed concrete.

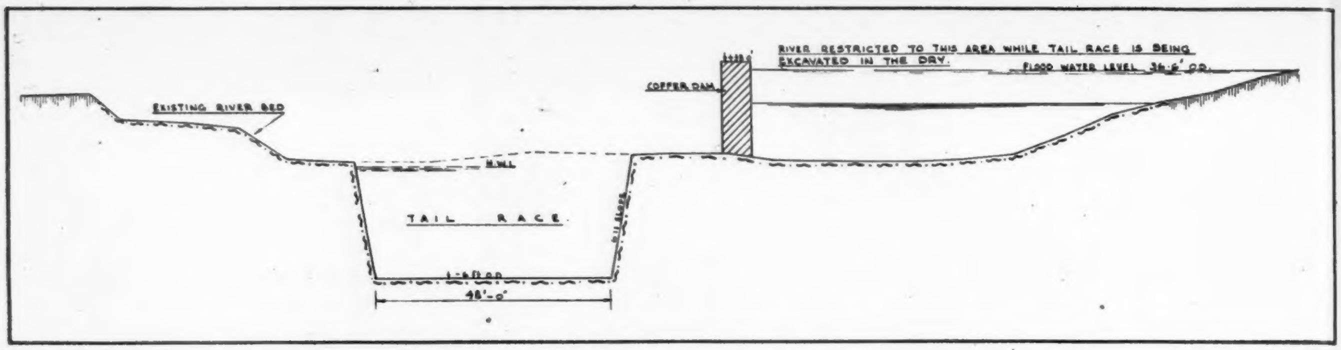
At the larger development at Cathaleen's Falls some 70,000 cubic yards of rock has been removed by the methods described to provide another 50-foot-wide diversion channel. There the formation is a hard limestone with almost horizontal bedding and has been drilled with X-71 and DA-35 drifters mounted on FM-2 wagon drills. In general, 25-foot holes were put down on 6-foot centers 5 to 6 feet back from the face, using 1¼-inch round steel and 2- to 1¾-inch Jackbits. Each line of holes was charged with 220 pounds of Polar Ammon gelignite fired with a Cordtex detonating fuse, except the end holes which were shot with delay detonators. The average consumption of explosive was 0.8 pound per cubic yard.

Where the dam site crosses the diversion channel, the latter has been widened and a block of concrete poured on either side of it. These two blocks are provided with culverts 15 feet high by 12 feet wide and will take the discharge of the river when the closing section of the dam is being poured across the channel between reinforced-concrete arch cofferdams after the remainder of the structure and intake have been completed. The culverts will then be closed with roller gates and the reservoir filled. The Erne has been successfully diverted into this channel and the river bed cofferdammed upstream and downstream of the site.

Because of the length of Cathaleen's Falls Dam the contractors decided to construct a bridge immediately downstream of the dam line for purposes of construction. The bridge, containing some 800 tons of structural steel, is 25 feet wide and carries three lines of 2-foot-gauge track for rock and concrete transport and two traveling derrick cranes with a capacity of 3 tons and a radius of 80 feet. Timber forms are being used throughout for concrete pouring. They are made up of standard 10-foot, 4-foot high panels of 2-inch sheeting with steel cantilever supports, and special care is taken to make sure that horizontal form joints are continuous the whole length of the dam. All concrete is placed by 1-cubic-yard bottom-dump Blaw-Knox buckets and compacted with Model 3V vibrators.

An extensive program of grouting the dam foundation is in progress and was begun in advance of the general work of excavating to speed up construction. The limestone is underlain by a hard watertight gneiss, and the grout holes on the line of the core trench are being drilled to this level to a maximum depth of 100 feet with DA-35 and X-71 drifters on FM-2 wagon drills. Hollow drill rods, with Jackbits ranging from 1⅞- to 1⅝-inch diameter, are being used be-

EXCAVATING DIVERSION CHANNEL
A view upstream of Cathaleen's Falls dam site, showing the river at the right and the diversion channel being excavated at the left. Approximately 70,000 cubic yards of rock was removed from the cut.



SECTION OF TAILRACE, CATHALEEN'S FALLS DAM

The tailrace will extend for half a mile from the dam to the tidal estuary. It is being excavated 25 feet deep, entailing the removal of about 200,000 cubic yards of rock, some of which is serving as concrete aggregate.

cause of the depth of the holes. Water is fed into the drill rods by means of specially designed water swivels between the rods and the shanks of the machines. The holes are put down and grouted in descending stages of 15 to 20 feet with pressures increasing with depth to 125 psi.

Some 60,000 cubic yards of rock has to be removed from the river bed for the power station. This material is required for aggregate production and has to be delivered at the main crushers on the north bank. To do this economically, a vertical shaft has been sunk there adjacent to the powerhouse site to a point 80 feet below the final excavation level. A sloping shaft connects the main shaft with the river bed. Two I-R 35-hp., 3-drum slusher hoists with a 1-cubic-yard scraper will move the limestone and deposit it in a trench from which it will be scraped into the sloping shaft and elevated to ground level. From there a belt conveyor will carry the material to the crushing plant.

The greater part of the tailrace is in rock, of which some 200,000 cubic yards has to removed. The method of procedure is to cofferdam half the river in sections and to load the excavated material into $1\frac{1}{3}$-cubic-yard dump cars by means of two electric slusher hoists on loading frames, utilizing 1-yard scrapers and working side by side in the bottom of the cut. The hoists are of the same type as those previously mentioned and have an average rope speed of 250 feet per minute. The cars will be lifted by an electric gantry spanning the excavation, will travel on a high-level track at river-bed level, and will be hauled by locomotives to the various dumps.

At the tailrace site, FM-2 wagon drills with X-71 drifters are also being used for blast-hole drilling, which is being carried to a depth of 25 feet. To limit overbreak on the sides and to obtain a cut with regular walls, line-hole drilling on 1-foot centers is being done along both sides down to the invert level with similar equipment ahead of the working face. Average drilling speeds of 20 feet an hour, including changes of steel, have been made on this work.

The earth dam which is to prevent flooding of the low-lying land adjoining Cathaleen's Falls Reservoir will require about 100,000 cubic yards of clay, which is being taken from a nearby borrow pit. Up to the limit of economic haul, the material is being excavated and placed by tractor-drawn 6-yard scrapers. The remainder is being removed from the pit by power shovels and transported by cars pulled by locomotives. Before use, the clay is tested in a laboratory that has been equipped for the purpose, as well as to determine the properties of cement, concrete, and aggregates from all building sites.

The material is being spread by bulldozer and compacted either by track vehicles or, if necessary, by sheep's-foot rollers. The dam has a slope on the water face of 2.5 to 1 and of 2.75 to 1 on the dry side, with a 6-foot-high pervious stone toe. To protect it in case of sudden drawdown, a layer of broken stone, varying from 12 to 2 feet in thickness, will be placed on the water face. Extensive drilling and cement injection was done on the line of the concrete core wall prior to filling.

The construction program provides for the completion of all works by the end of 1950, and progress to date indicates that this goal will be reached. When fully developed, the project will make available annually some 200 million units, a contribution that will go far towards meeting the rapidly increasing demand for electric power in Eire.

DRILLING GROUT HOLES

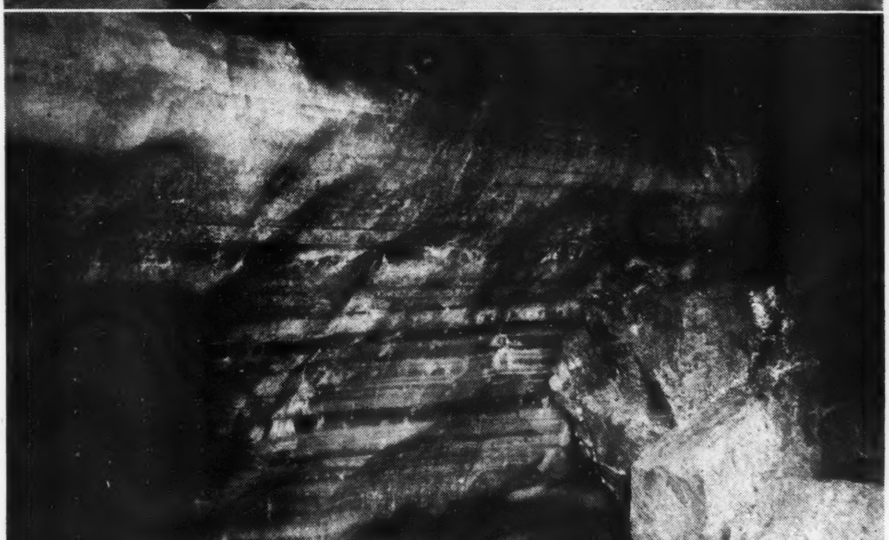
Along one side of the reservoir area behind Cathaleen's Falls Dam is being reared an earth dam with a concrete core wall to prevent flooding of adjoining low-lying areas. Prior to filling the core-wall trench, cement grout was injected into the ground on each side of it to prevent seepage. This view along the dam axis shows an FM-2 wagon drill putting down a grout hole.

Desert Ice Caves

E. R. Harrington

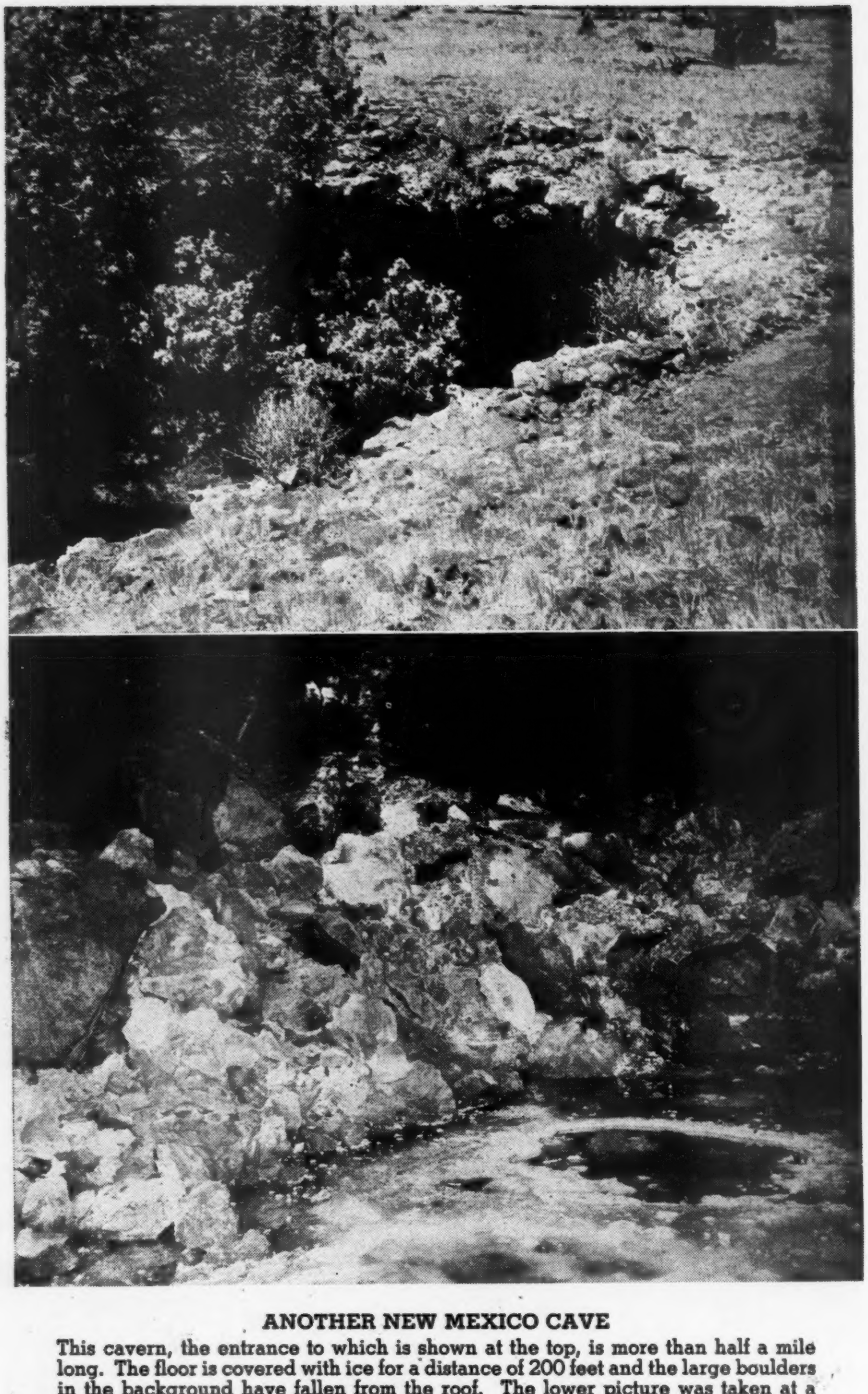
HOT summer days can be really hot out on a desert of black lava. The temperature tops 100°F. in the shade, and the only shade is afforded by an occasional sagebrush. Your trail winds over a jagged surface to a big hole in the ground and there, beneath an overhanging ledge, is a large block of ice barely out of range of the direct rays of the sun. Ice in the desert? Nature's own refrigerator at work!

You are visiting an ice cave. You knew it was there and you have seen others before, but the thrill is the same each time. On the surface, the basalt rock is almost too hot to touch, yet only 50 feet away the thermometer reads 50°F. Somehow you feel it can't be real, but there's the evidence. Perhaps it is the ice cave in the Black Butte area north of Shoshone, Idaho, or maybe one of several in the Craters of the Moon region in the same state. There are some large ones in the Modoc lava beds in northern California. Others are in the basalt flows of Oregon, Utah, Arizona, and New Mexico. Regardless of the location, the beholder experiences an unforgetable sensation. And, unfail-



CAVE NEAR GRANTS, NEW MEXICO

Caving of a section of the roof of a conduit through which molten lava once ran has produced the pit opening shown at the top. In the background is Bandera Butte, a cinder cone that was formed in recent geological time. Inside the cave, less than 15 feet from the range of the sun's rays (center view), the floor is a sheet of ice and there is a solid wall of it 15 feet high, 20 feet deep, and 50 feet long. This picture and the bottom one reveal the stratified structure, an indication that the ice was built up year by year. The photographs were taken late in July when the outside daytime temperature was around 100° in the shade.



ANOTHER NEW MEXICO CAVE

This cavern, the entrance to which is shown at the top, is more than half a mile long. The floor is covered with ice for a distance of 200 feet and the large boulders in the background have fallen from the roof. The lower picture was taken at a point 150 feet back from the entrance.

ingly, each visitor asks the same question: "How did that ice get in that cavern out there on the desert?" Perhaps we can find a logical answer.

All the ice caves have certain things in common and unfailingly are situated where low freezing temperatures are experienced in winter. A surprisingly large number of them face south. With possibly one or two exceptions they are in black lava (basalt), a rock shot through by gas tubes, cracks, and holes. In those of which we have knowledge, the air circulation is comparatively vigorous in the coldest weather and much restricted during the hot months. These common factors give an inkling as to why such caves should contain ice the year round.

Caverns of various kinds are frequently found in basalt, which issued from fissures and vents in a highly liquid state and flowed outward almost as freely as water. The surface cooled first while the volcanic rock underneath remained molten and continued to flow until it was confined in well-developed underground channels which radiated from the main vents. Eventually, a large percentage of the lava drained away, leaving long snakelike conduits. Later, collapse of the roofs provided entrances to these subterranean passages. The writer has followed such conduit caves for more than a mile.

Basalt shrinks considerably upon cooling, and on that account is full of cracks. Surface water from snows can readily gain admission into the winding caves, and air can usually circulate freely. In certain of them there are restrictions to the air flow, and it is in these that ice is found. If the circulation were the same both summer and winter, no ice would remain throughout the hot months unless the region had a mean temperature of less than 32°F., and if it were slight in both seasons no ice would form at any time because the conditions would duplicate those found in a farmer's root cellar. To produce ice and to have it stay the summer through necessitates rather free air circulation in winter so the moisture will freeze, and restricted circulation in summer to preserve the ice so formed. Many smoke tests made in the ice caverns of Idaho and New Mexico have demonstrated the correctness of the theory advanced.

Now for an explanation as to the cause of the phenomenon. It might possibly occur in more than one way. In the case of a cave facing south, as a number do, the sun is low on the southern horizon in winter and shines far back under its overhanging ledge. In such a protected position the temperature of the pit in front of the cavern is much higher than that of the flat lava which covers the back of the cave. This difference in temperature causes the cold and heavy air to move downward through the fissures in the volcanic rock and into the cavern, while the warm, lighter air in the pit at the entrance will rise. These two air movements will sweep the cave full of cold air on the coldest winter days. Any water that has seeped through the cracks in the lava will be frozen by this cold air. As the water congeals, it gives up its heat of fusion to the surrounding air, thus warming it. This slightly warmed air is displaced by the heavier, cold air coming in through the fissures in the thick basalt roof.

In the summertime, when the sun is almost directly overhead, its rays no longer shine far under the overhanging cliff. Now the temperature of the pit differs little from that of the flat lava which covers the cave, with the result that there is not much likelihood of air circulating through it. Any slight movement that is set up will cause a certain amount of the ice to melt in the summertime. As it does so and takes up its heat of fusion from the air, the latter is chilled to a temperature far below that of the outside air. Under these circumstances the heavier air is inside the cavern where it has little chance

CINDER CONE

A view inside Bandera Butte, a cinder cone that is a comparatively recent manifestation of volcanism that produced the caves in which ice is found. This butte forms the background of the picture at the top of page seven.

of being swept out by the warm air above it. This restricted circulation prevents any appreciable quantity of the accumulated ice from melting.

Even if the cave were not facing south, some of the aforementioned conditions would still prevail. In winter, a lava cavern can "drink in" a surprisingly large amount of cold air because of its fissured nature. The cold air finds its way down into the thousands of tiny pores and cracks, forcing the warm air out. Basalt is a poor conductor of heat by reason of its open texture, but this does not hinder the cold air from "soaking" down into the fissures and displacing the warm air in the process. When summer comes, the warm air cannot push the heavier cold air from those pockets. It could be driven out only by first warming the rock which covers the cave, something that would be difficult to achieve because of the good insulating properties of lava. Here again, the result is a marked inward movement of cold air in winter and a much reduced outward movement of the same air in summer. Hence a considerable quantity of ice formed in winter lingers through the hot months.

One often hears the statement that the ice in these desert caverns melts in winter and freezes in summer. That is not the case. In the early spring, when snow starts to disappear, more water than normally seeps into the caves, and the cold air that was drawn into them in winter congeals it, often giving the ceiling beautiful coatings of large ice crystals. Following an exceptionally severe winter, the air inside a cavern may be cold enough to continue the freezing process well into the summer, the period depending upon how much water has dripped in. Usually, however, midsummer finds the ice in a cave melting slowly, and this goes on until winter's cold sets in. It is a rare thing to find one so cold that the ceiling ice crystals endure through the summer.

Each cavern has its own peculiarities. The Crystal Ice Cave near Trechado, N. Mex., is characterized by a fine display of crystals which linger far into late spring. The Grants Cave, in the same state, is marked by a huge block of ice near the entrance and barely out of reach of the sun's rays. Its companion, 2 miles to the south, is remarkable because many of the fissures in its roof are ice-filled. The distinctive feature of the Shoshone Cave is a long floor of ice ending in an ice wall that once completely closed its mouth. When it was made accessible by another opening, the air began to circulate more freely than it had and in a few years much of the ice formation had disappeared. (The writer understands that the old entrance has been restored and that the ice is making a comeback.) The northern California caverns are notable for their great size, at least one of them being more than half a mile in length.

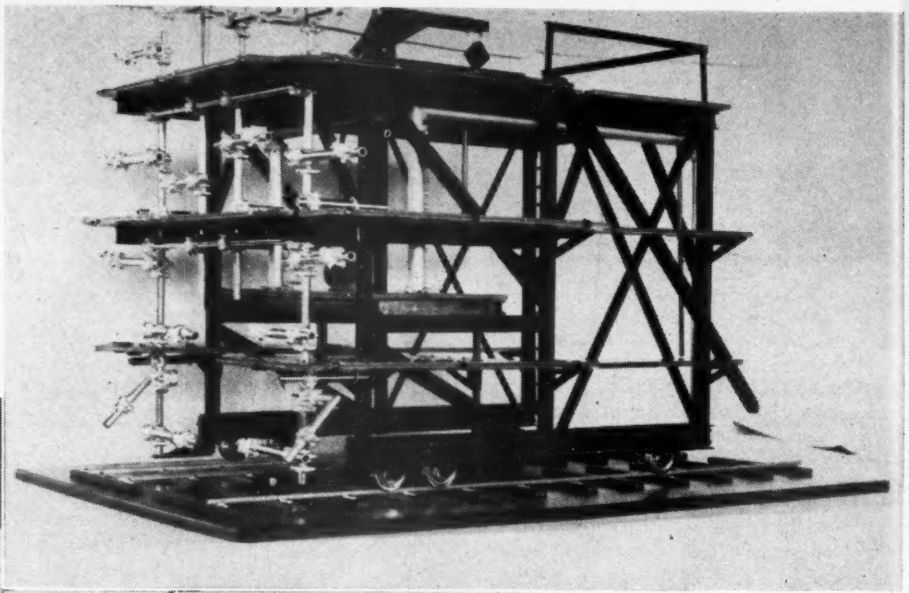
No matter where located, each ice cave has certain characteristics that set it apart from the others; but, even so, all have one thing in common. They startle you. In summer, when you make that hard walk out across the broken and twisted lava, which is as hot as a stove top, you just can't bring yourself to believe that ice and freezing temperatures exist in a cavern a few yards beneath your feet!

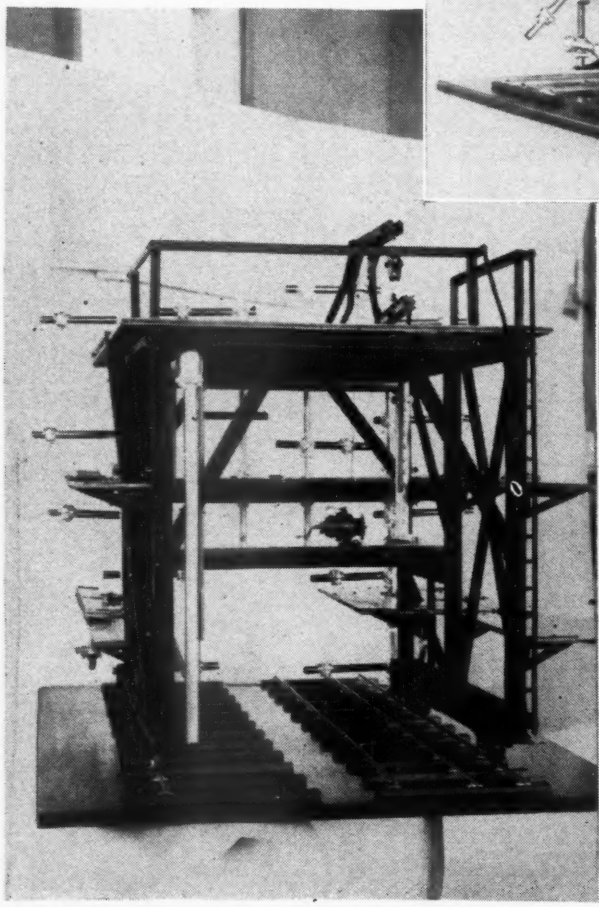
CRYSTAL ICE CAVE

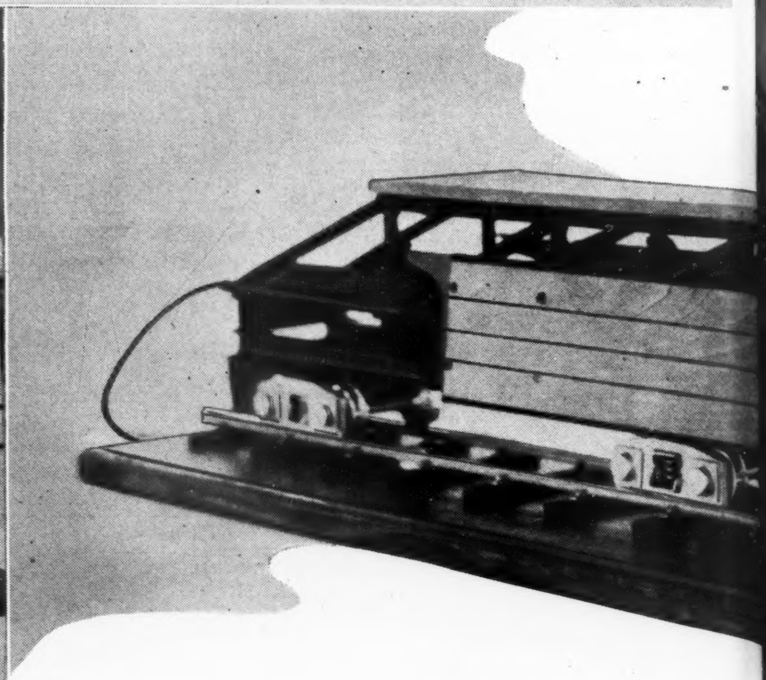
Located 30 miles from Trechado, N. Mex., this cave is reached by slow, hard traveling across rough terrain. Its entrance is seen at the top. The lower picture, taken 200 feet inside the cavern, shows solid ice on the floor and crystals of ice covering the sides and roof.

DRILL CARRIAGE

The model pictured at the right and below is a large-type drill carriage with four drifters mounted at each of its four working levels. An air hoist on the lowest of its three platforms (center of view below) powers a jib crane on the top deck that is used to operate a "cherry picker" muck-car switcher and to lift materials to the upper platforms.



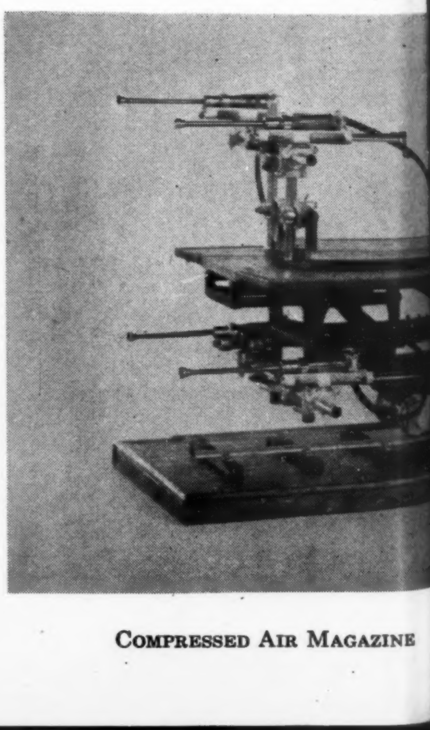




Models Aid Builders of Machinery

MODELS of mechanical equipment are being used increasingly for a variety of purposes. They have long been popular as displays at conventions and in schools and museums. More recently they have appeared in the role of sales aids, supplementing literature and photographs. As such they enable a prospective customer to see a piece of apparatus in detail without obliging him to stir out of his office. In many instances they save long trips that would otherwise be required to observe full-size equipment at work in the field. Engineers of companies that make machinery are likewise finding them valuable as a means of solving problems of design and construction, as well as operation.

To be of greatest effectiveness, models must be true to scale and capable of executing the principal movements of their larger counterparts. Accompanying pictures show miniature reproductions of mining machinery that are being used to good advantage in the British Isles by Ingersoll-Rand Company, Ltd. Although most mechanical models are turned out by specialists in that line, these particular ones were made by K.A.



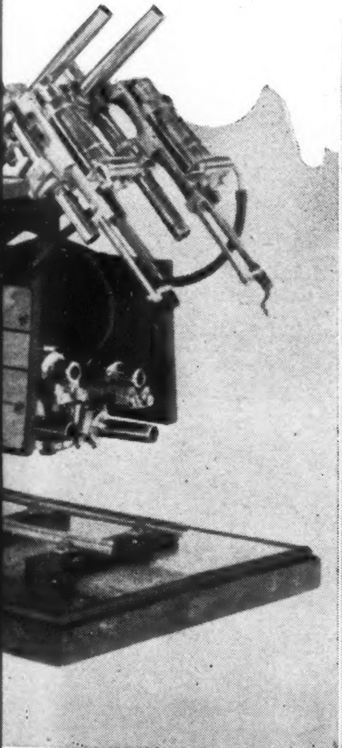
Chubb, chief engineer of the company's factory in Manchester, England. He builds them during spare hours in a workshop in his home and has thus made a hobby out of something that is closely associated with his regular occupation.

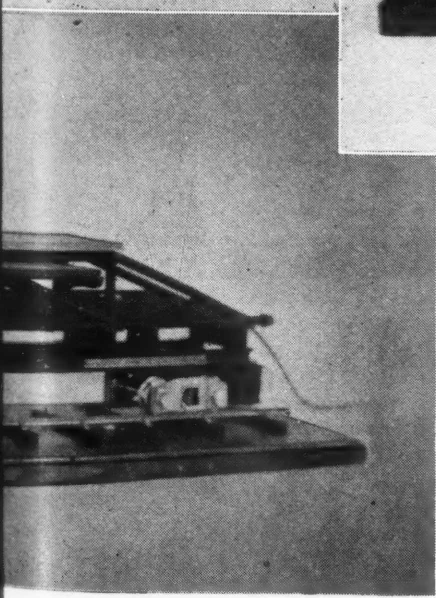
The reproductions are on a scale of one inch to a foot. Their bodies are coated with a black crackle stove enamel similar to that applied to some pieces of office equipment. This has proved satisfactory because it wears well and does not show finger marks. Working parts are finished in bright chrome plating.

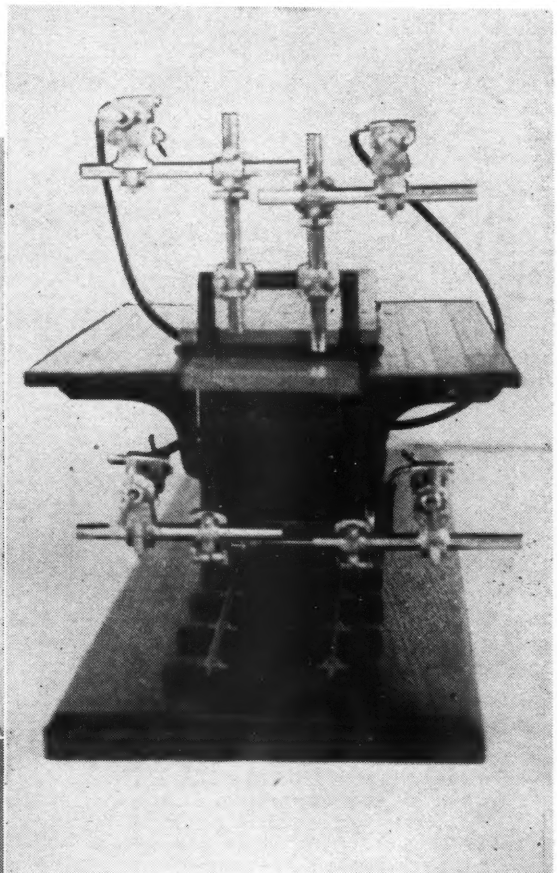
There are models of drill carriages, loaders, and various types of car-switching devices, all of which are used in tunneling rock. They have been helpful and interesting as displays on occasions when motion pictures of the driving of large American tunnels have been shown to mine officials and operators, engineering-college students, and other groups. The company's salesmen often find them of service in explaining to prospective customers the merits of the equipment they sell, and they are invaluable to its engineers because they make it possible to check working clearances, to devise ways of applying machines to actual jobs, etc.

FOUR-DRILL "JUMBO"

Below are views from three angles of a drill carriage designed for driving a small-bore tunnel. Replicas of DA-35 drifters are mounted on miniature columns and arms, and the model is a faithful representation of its larger counterpart, even to the collapsing side platforms. It runs on a 2-inch-gauge track.







Pneumatic Operation of Model Railroads

MANY operations on model-railroad systems may be performed pneumatically with inexpensive and easily constructed apparatus. Dependable, sufficiently powerful for the purpose, as well as adjustable as to speed of operation, pneumatic control may be used to throw switches, relay electric circuits, lower crossing gates, raise lift bridges, and do numerous other jobs on the main line or in the yard.

For the benefit of the uninitiated, model railroading is a fascinating hobby whose followers exhibit an almost fanatical interest in constructing and running miniature systems. More than 25,000 adults on this continent spend some of their spare time in painstakingly reproducing scale models of locomotives, cars, roadbeds, bridges, stations, and innumerable accessories. In their zeal for accuracy they often work to tolerances of 1/1000 inch and even take into consideration the depth of a coat of paint. A sense of realism is imparted by painted backdrops, model towns, and remote-controlled switches, signals, and lighting. These amateur railroaders have clubrooms in many cities where they set up and run trains. They even have their own monthly trade journal, the *Model Railroader*, which recently published an article on pneumatic operation by Don Clark.

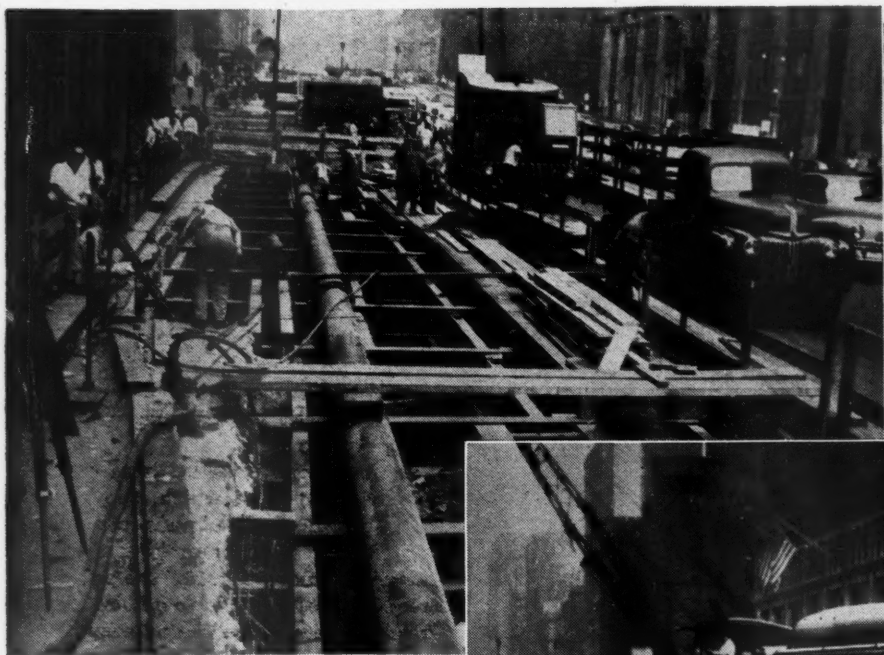
The system described is operated by means of vacuum which, though little used on standard railroads in this country, is employed for braking service on English trains. Most of the equipment required to apply it to miniature railroad layouts is simple and easy to procure. Small pneumatic bellows do all the work necessary to carry out the various functions and are controlled electrically by magnets of the type used in pipe organs. These magnets are, in turn, actuated by push buttons or switches such as are usually found on a control board.

A vacuum system of this kind can be readily constructed from an old player-piano "stack" that is often to be had from a used-piano dealer for the asking and that will provide nearly a hundred pneumatic bellows, each acting independently. It will also supply the railroader with such necessary hardware as screws of varying length and size, metal rods, springs, wheels, bearings, etc.

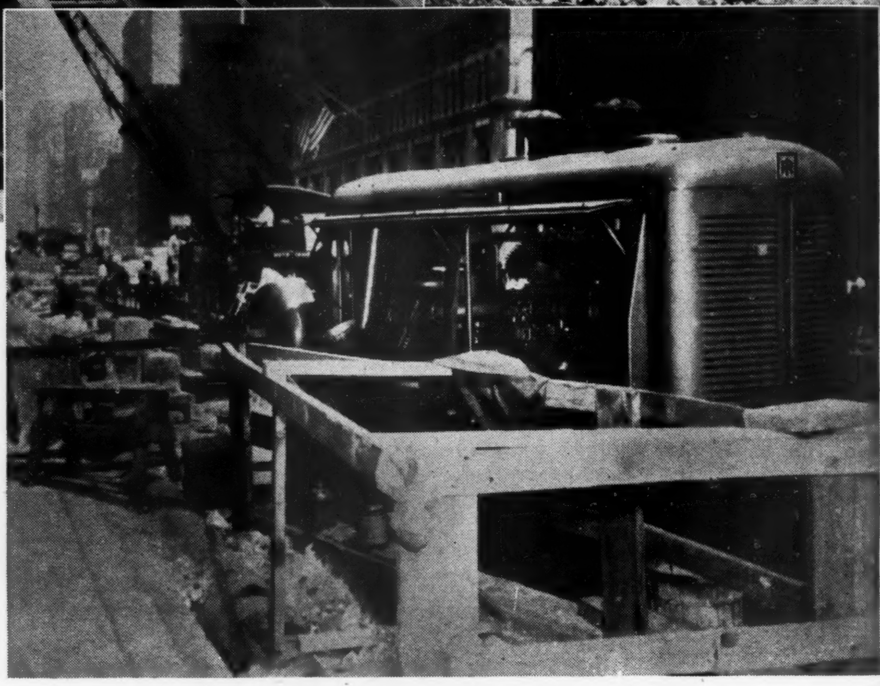
A section of the stack with as many bellows as may be needed is cut off and fitted with wiring running to the control board from each magnet on the stack. The bellows are removed, placed in their various operating positions, and connected to the stack by rubber tubing. Vacuum is applied by an electrically driven vacuum pump, which is the most expensive piece of apparatus in the system.

Advantages of pneumatic control are: sure and powerful action, the elimination of heavy wiring from the control board, and a wide range of applications. Further, it relieves overloaded electrical systems, and each unit may be operated slowly or with the speed of an electric relay merely by adjusting the size of the opening through which the air escapes. This makes it possible to slow down the various operations to a point where visitors can easily follow the procedure.

Extending Gotham's Old Subway Platforms



COMPRESSED AIR & INSTITUTE PHOTO



OPENING THE STREET

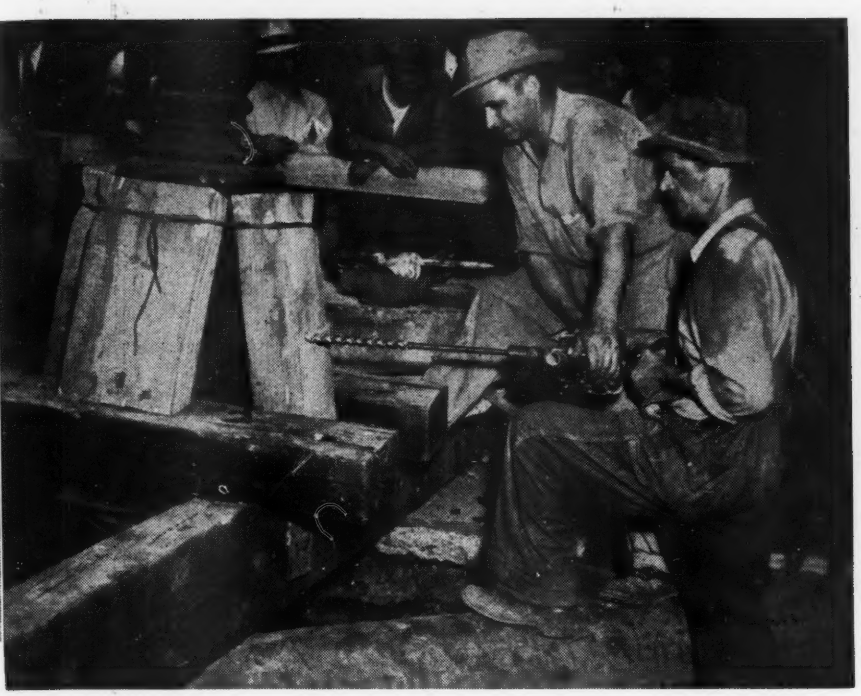
A general view (upper left) of the work on one side of Fourth Avenue near 33rd Street. Steelwork to support decking and, later, the permanent street surface, has been put in place and excavating is proceeding underneath. Pedestrians have been limited to a narrow sidewalk at the left. In the section concerned, the subway tracks are only about 20 feet underground, with little space between the roof of the structure and the street surface. This complicates the problem of maintaining and relocating the maze of water and gas mains; light, power, and telephone conduits; and other utilities, including a pneumatic postal tube. Thus far, the latter has remained in continuous service, without delaying delivery of a single letter. The picture just above shows one of four portable compressors that furnish compressed air for numerous services. It is a 500-cfm. unit. Beyond it is a crane that powers a clamshell excavating bucket and also handles steel and other essential materials.

NEW YORK CITY'S first underground railroad began operating in October, 1904. It was confined to Manhattan, the heart of the 5-borough metropolis. Except for a crosstown jog at about the center, it ran lengthwise of the narrow island, which averages only 2 miles in width. Since then the subway system has been repeatedly expanded and now sends its numerous tentacles far out into four of the five boroughs. Every extension served, however, to increase the congestion in Manhattan, for that borough is the focal point into which pour wage earners by day and pleasure-seekers by night. It is the commercial, financial, and amusement center that draws hordes of diurnal travelers not only from other parts of the city but also from neighboring sections of New York, New Jersey, and Connecticut. Added to these regular visitors are itinerants from various corners of the globe who come and go but are always sufficient in themselves to populate a fair-sized community.

Manhattan, then, is the bottleneck of the rapid-transit system and, for that matter, of all other forms of traffic. In an effort to alleviate the pressure upon it, there have been built since the initial subway was opened four additional underground lines that pass through all or a goodly part of the island's 16-mile length, with their termini in adjoining boroughs. And only last December the Board of Transportation put forward a proposal to construct still another at an estimated cost of $400,000,000, without equipment. Its principal purpose would be to lighten the load now imposed upon the Manhattan sections of the system.

Under present conditions, so many lines feed into Manhattan that the facilities there can't handle the load humanely. Conversely, at times when traffic is flowing from the island, its subways can't move people in a volume great enough to load the lines that fan out into other boroughs to the limit of their capacities. This despite the fact that trains on all lines run through Manhattan at intervals of approximately two minutes. Closer operation cannot be considered because it would be unsafe.

Statistics tell the story and also serve to emphasize the hugeness of this railroad system which, although confined to one city, has enough trackage (746 miles) to reach from New York to Cincinnati, Ohio, or from Chicago, Ill., to Vicksburg, Miss. In the fiscal year ended last June



AIR TOOLS IN USE

As traffic moves overhead on temporary decking, a workman (above, left) employs a paving breaker to tear away some old concrete encountered in excavating. The view above shows an air drill putting a hole in one of the timbers that serve to brace a light standard.

30, the unified subway lines carried 2,051,400,973 revenue passengers, or a daily average of 5,620,277 persons. Car miles traveled aggregated 370,285,557. In propelling and lighting the cars and the rights of way, operating signals, etc., a total of 1,658,462,062 kilowatt-hours of electric current was consumed. Significant is the fact revealed by the figures that about eight out of every twenty fares paid were dropped through turnstile slots in Manhattan.

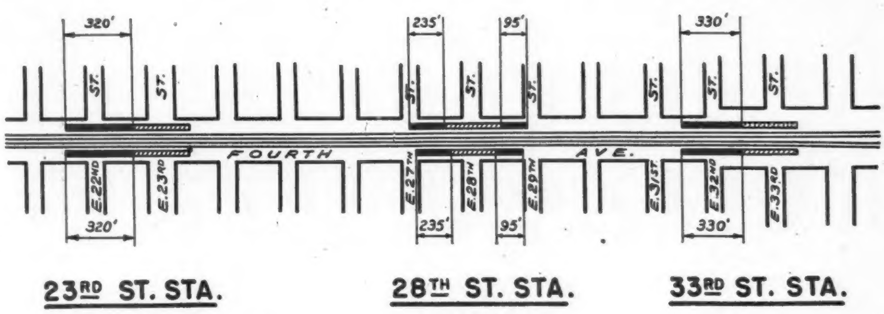
In 1900, when construction on the first subway was started, Greater New York had 3,437,202 inhabitants of which more than half lived in Manhattan. Brooklyn was the only other sizable subdivision, with 1,166,582 persons. The boroughs of The Bronx and Queens had a combined population of around 350,000. The remaining borough, Richmond, numbered but 67,000 and can be ignored for present purposes because it is not served by subway lines. Today, however, there are an estimated 7,835,000 persons in the five boroughs. Of the increase of approximately 4,400,000 in the intervening 47 years Manhattan has received only some 50,000. Brooklyn, however, has mushroomed and is now the most populous borough with 2,800,000 inhabitants, while The Bronx and Queens each have about 1,500,000. With Manhattan still the business and pleasure hub, it is easy to see why its transit facilities are overtaxed.

Besides planning additional subway lines, the Board of Transportation is attempting to ease the situation by increasing the carrying capacities of some of the older parts of the system. This is being done by lengthening many local stations in Manhattan so that longer trains can be run. Those concerned are all on the IRT (Interborough Rapid Transit) Division, the first one built. The work is currently going on at a cost of $13,327,700.

The typical New York subway consists of four tracks. The two center ones are for express trains and the two outer ones for local trains, thus providing for dual movement in opposite directions. The original lines were laid out with express-stop stations of sufficient length to load and unload 10-car trains, but the local-stop stations accommodated only 6-car trains. These facilities were more than ample in 1904, and it was impossible at that time to foresee just when they would be overtaxed. The same situation prevailed in 1917, when the first additional lines went into service. Since then, with a better realization of future requirements, all new construction has specified both express- and local-stop stations with platforms extensive enough to accommodate trains ten or more cars long. The last to be completed on what is now the Independent Division provided express-stop platforms 660 feet long and local-stop platforms 600 feet long. Another change that was made spaced local stations in Manhattan approximately half a mile apart, or twice the interval prevailing on the older lines.

The platform-extension program has been divided into seven groups, each of which includes several stations. The operations involved are essentially the same in all cases. Accompanying pictures show various aspects of the job that is being done jointly by Arthur A. Johnson Corporation and Mason & Hanger, Inc., at the 23rd, 28th, and 33rd street stations of the Lexington Avenue-Fourth Avenue IRT. The appropriation for this section is $4,003,000. The contractors started work last February and are allowed fifteen months, or until April of this year, to complete the project.

All three of the stations are on the initial subway line that dates from 1904. In the last fiscal year their turnstiles collected 20,268,850 fares, or an average of 55,500 a day, and it is safe to assume that approximately that number of persons left trains at those points. In the stretch of its route affected, the line runs underneath Fourth Avenue, which is flanked by multistory office and commerical buildings. Both Fourth Avenue and the streets that cross it are heavily traveled. The contractors are required to "protect, maintain, and support all structures, including surface railroads, monuments, water mains, gas pipes, conduits, etc.," and they must carry on their work with a minimum of interference with street and sidewalk traffic. They

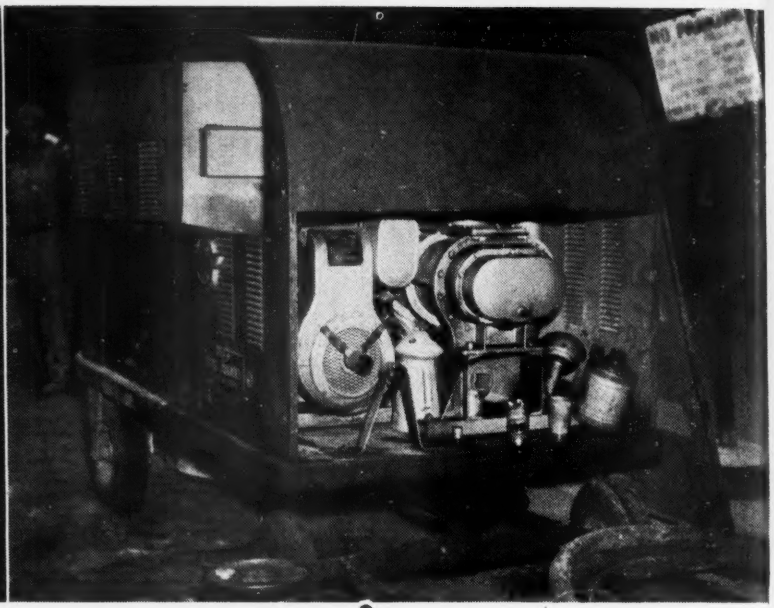


LEGEND

EXISTING STATION PLATFORM
NEW CONSTRUCTION

PLAN OF WORK AT THREE STATIONS

Existing platforms will accommodate only four full car lengths of the 6-car local trains that are now run, and the front and rear cars can load and unload passengers through only one of their two doors. When lengthened, the platforms will provide access to all doors on 10-car trains.



REMOVING DRILLING DUST

Although the rock drill shown at the left was running when the picture was taken, no dust is visible. Dust emerging from the hole is sucked into the hose and conveyed to the collector shown at the right. Approximately 6000 holes will have to be drilled in rock and concrete in the course of the work.

must remove, relocate, and reinstall subway equipment such as signal, power, and lighting conduits and devices. All their activities must be conducted so as not to delay or interrupt subway service, which is provided 24 hours a day.

At 23rd Street, the platforms on both sides of the tracks will be extended 320 feet at the south ends. Both platforms at 28th Street will be lengthened 235 feet at the south ends and 95 feet at the north ends, making a total of 330 feet on each side. Both platforms at 33rd Street will be extended 330 feet at the southern ends.

As the station walls abut the building line on each side of the street, the areas being excavated are largely underneath the sidwalks. In many cases basement vaults, freight elevators, manhole entries, and other structures reach into these spaces and must be carefully removed. All told, there are 33 large buildings whose foundations have to be safeguarded, and in some instances this entails underpinning.

The general method of procedure is to open up the working areas from the surface. To keep street traffic moving at near its normal rate, it is necessary to do this a small section at a time. Each one thus exposed is decked over as soon as possible, and then the adjoining section is treated in like manner. Eventually, the entire area is covered, save for occasional openings for bringing up excavated material and taking down equipment and materials. Thus, most of the activities go on unseen by passers-by. It is required that the decking be substantial enough to support a load of 250 pounds per square foot.

As is true of most construction jobs, compressed-air power is largely relied upon to perform many of the operations involved. The first step consists in opening up the street and sidewalk with hand-held rock drills or pavement breakers. When subsurface soil is reached, it is removed by a clamshell bucket on a truck-mounted crane. As excavation progresses, vault walls are encountered. These are ordinarily of brick or concrete and from 2 to 3 feet thick. They are generally broken up in sections by drilling a series of holes in which wedges are inserted. The detached piece may weigh a ton or more and is removed by putting a chain sling around it and hoisting it out with a crane. Much the same procedure is followed in tearing down an aggregate of 2500 cubic yards of subway boundary walls. These are approximately 9 inches thick and consist of a center layer of conduit structure, with brick on one side and concrete on the other.

Occasionally, ledge rock in place is struck and must be excavated by drilling and blasting. To prevent damage to adjacent structures, only small charges of powder are used, and this calls for drilling numerous closely spaced holes. Blasting is rigidly supervised by the Board of Transportation's engineers and is permitted only at certain times of the night when traffic overhead is light. The regulations permit storing on or near the job only a normal 12-hours' supply of explosives.

All rock drilling is subject to dust control by equipment approved by the Industrial Board of the New York State Labor Department. The apparatus in service is essentially a large-size vacuum cleaner, wheel mounted for portability. Suction is induced by a rotary, gasoline-engine-powered blower. Dust-laden air drawn in through hoses passes first through a settling chamber and then through a series of canvas tube filters.

Air-powered drills are used for putting holes in steelwork preparatory to riveting and through wooden beams and other forms where bolting is required. In one case, an air hammer was rigged on a crane to drive steel I-beams into the ground to support a wall designed for retaining earth. Air-operated sump pumps that can be carried around with ease remove casual water as well as that accumulating after a storm.

Four portable compressors furnish air for the various purposes mentioned. Three of them are of 500-cfm. capacity and one is rated at 110 cfm. One of the larger units is driven by a diesel engine, while the three others use gasoline for fuel. As the three separate working zones are within an over-all distance of approximately half a mile, the compressors can be moved quickly from one to another to meet fluctuating air demands at the different sites.

The contract includes the construction of new entrances to the enlarged stations, finishing interior walls with tile and mosaic to match those in place, and various other details. About 200 men are employed on a 3-shift basis.

Determining Blow Energy of Rock Drills

J. D. Ditson

TESTING machines are employed to some extent in the development of rock drills, and there is a current tendency to use the results thus obtained as a means of comparing the performance characteristics of various drills. As is frequently the case, the apparent results of this sort of test can be misleading if the machines' inherent drawbacks are not understood. Consequently, a discussion of their limitations is believed to be desirable in view of the increased attention that is being focused on drill blow energy and its relation to the performance of hard-faced bits of the Carset type.

European advertisements of the hard-faced bit frequently place much stress on not exceeding a certain blow energy if adequate bit performance is to be obtained, but they do not indicate any procedure for determining that energy. This puts the user at a considerable disadvantage because there is no established standardized procedure for measuring blow energy, and he must either accept the figures furnished by the drill manufacturer or get results from a testing machine. Unfortunately, the results may vary considerably, depending upon how the machine is utilized and calibrated; and, as a consequence, blow-energy figures of a specific drill obtained from several different sources may show wide divergence.

Testing-machine results do not indicate the true blow energy in the piston or the drill steel. Superficially, considering the methods of calibration, a machine of the Paynter type would appear to be the ideal means of determining the energy output of a percussion tool. It is well known that a falling weight acquires energy of motion proportional to the force (in this case its own weight) acting upon it and the distance through which this force acts. If an indicator is available, and these testing machines are indicators, it seems logical to permit a falling weight to strike it and to suppose that the reading given is proportional to the kinetic energy in the striking mass. Further, if a drill produces the same result, it is reasonable to assume that the drill blow must have had the same energy. While this logic is sound, it overlooks one fundamental characteristic of impact—that of coupling. Coupling is the capacity of the striking mass to transfer its energy to the struck mass, and herein lies the testing machine's greatest fault.

Elementary-physics books frequently use two billiard balls as an example in discussing impact. It is pointed out that if the balls are of the same mass and that if one, at rest, is struck by the other traveling at some velocity, the moving ball will come to a standstill and the ball previously at rest will acquire the velocity of the one originally in motion. But if this is to occur, the balls, it is stressed, must have a high restitution factor and equal mass.

Similarly, every schoolboy who has played with marbles knows that a light one will rebound from a large one and that marbles will bounce when dropped on a smooth sidewalk. Illustrations in elementary physics show us that a small mass striking a mass much larger than itself will rebound with substantially the same velocity at which it moved before impact, the only change undergone by the striking mass being a reversal in the direction of its course. From an energy standpoint, however, it is apparent that in the case of the billiard balls of like mass the energy transfer was complete, but that there was no such transfer in the case of the marble on the sidewalk. If, instead of the marble, the schoolboy had dropped a billiard ball from a height that would have caused it to travel at the same velocity as the moving billiard ball in the first illustration, the striking velocities and therefore the blow energies of both would have been the same, but the energy transferred would have been substantially 100 percent in one case and zero in the other.

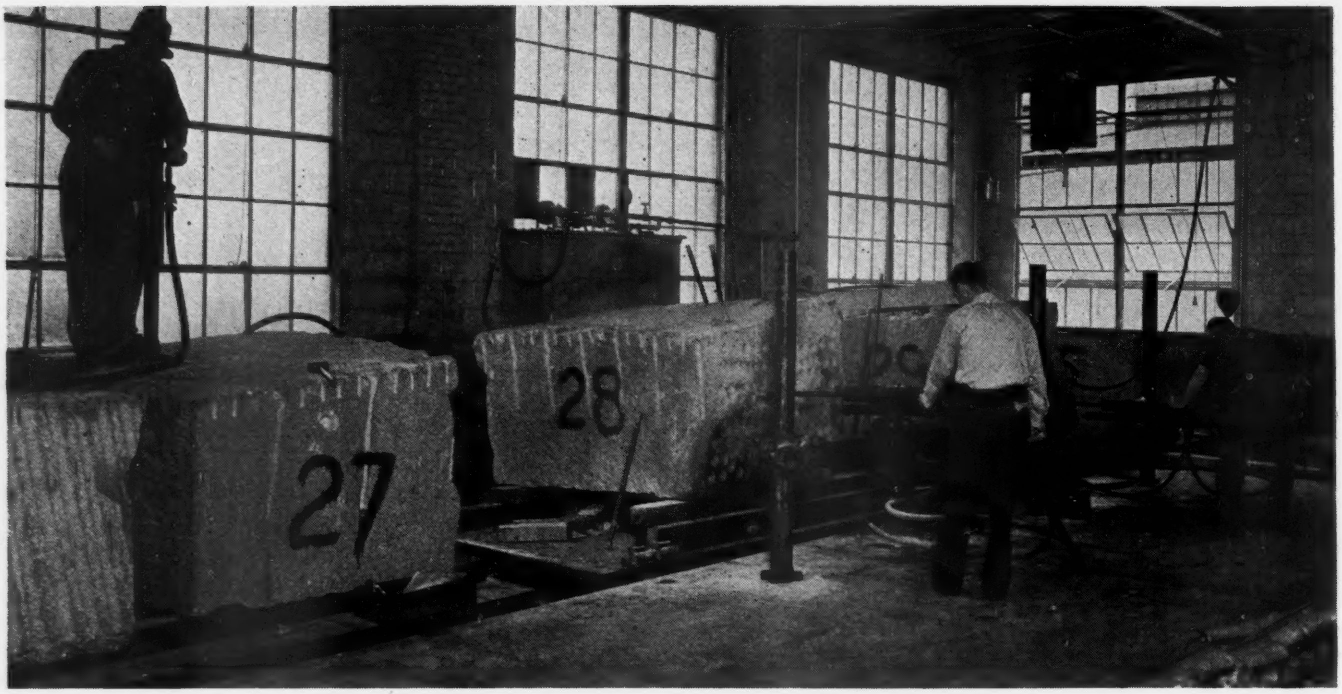
Now, if we remember that a rock drill is somewhat like the two billiard balls, with the mass of the piston adjusted to the mass of the steel to obtain the optimum energy transfer, it is apparent that the amount of energy that can be transmitted to the same steel with the same blow energy will not be the same if the mass of the striking object or piston is changed to any appreciable extent. This is a serious point of departure in testing machines.

Calibration of the machines is generally accomplished by permitting a rather large weight to drop a reasonable distance so as to obtain the necessary energy. If the weight of the calibrating mass were reduced to that of a rock-drill piston, the distance it would have to fall in order to deliver a blow equivalent to that of the piston in normal operation would be in the neighborhood of 30 feet. As this is somewhat impractical, the height of the drop is considerably shortened and the calibrating mass is proportionately increased in order to bring the blow energy up to the piston-blow indication. This large discrepancy in mass upsets the calibration figures and invalidates the results. The error, in fact, is of such a magnitude that the use of two different calibrating weights having a weight ratio of 2 will not produce results that will check with any reasonable degree of accuracy, and the normal calibrating-weight and piston-weight ratio is approximately in the order of 6.

The blow energy of a rock-drill piston is also dependent upon the extent of the rebound from rock and steel combined, and there is little similarity between the rebound factor of a testing machine and that of a rock face. A simile to illustrate this effect is provided by the schoolboy with his marble on the concrete sidewalk. After determining how high he has to hold his hand to catch the marble as it bounces on the concrete, he moves over to a mud puddle and finds that it will not reach the same height upon striking this medium. As rebound height plays a part

GRANITE BLOCKS FOR TESTING ROCK DRILLS

Blocks of Barre, Vt., granite have been used for many years for testing rock drills produced by Ingersoll-Rand Company. Note the one near the center that has been riddled with holes. A set-up for testing stoper drills is being made at the left.



ROCK DRILLS UNDER TEST

At the Ingersoll-Rand factory, granite blocks are run into the testing department on flatcars. Prior to being approved for shipment, each new drill must meet a prescribed standard of drilling efficiency.

in the speed with which the marble will recycle, it is evident that the boy will not be able to repeat the cycle as rapidly in the case of mud.

For these reasons testing-machine results are misleading. First, because of the calibrating procedure that must be followed to keep the process simple, the figures indicated are not equivalent to the blow energy developed by a drill; and second, the machines do not perform normally on account of their rebound characteristics. Fortunately, there are ways of arriving at the blow energy in the piston while a drill is running under normal conditions. By a method that is used frequently, an oscillograph trace is obtained of the stroke versus time relationship of the piston. This makes it possible to determine striking velocity from the slope of the tangent to the curve at the instant preceding impact. This procedure requires specialized equipment and a rather elaborate technique, which is not generally available.

A study of many of these stroke-time diagrams, however, has disclosed certain peculiarities of rock drills which permit the use of a rather simple method of approximating the blow energy. It has been found that the ratio of blow-stroke time to return-stroke time is substantially constant at 45 percent of the total piston-cycle time for all normal operating pressures and regardless of variations in detail design of present-day commercial machines. Similarly, it has been found that the striking velocity of the piston seems to be 1.75 times the average velocity of the piston on the forward stroke. By means of these ratios it is possible to set up a general formula for approximating piston-blow energy, using the generally known or readily obtainable measurements usually associated with rock drills.

The number of blows per minute is generally known, so it is possible to determine the piston-cycle time. Stating it in time units of seconds:

$$\text{Piston-cycle time} = \frac{60}{BPM} \text{ seconds}$$

$$\text{Blow-stroke time} = \frac{.45 \times 60}{BPM}$$

Stroke also is generally known or can be established without too much difficulty. A note of caution, however, is in order. The stroke should be the working stroke as determined while the machine is actually operating under normal conditions.

Now if stroke in feet is divided by the blow-stroke time, the result will be the average blow-stroke velocity in feet per second, provided the measurement units of the stroke are in feet. However, as it is usually more convenient to measure stroke in inches, by inserting a conversion factor the average velocity on the forward stroke can be written:

$$\text{Average velocity blow stroke} = \frac{\frac{S}{12}}{\frac{.45 \times 60}{BPM}} = \frac{S \times BPM}{12 \times .45 \times 60}$$

And as the final velocity is equal to 1.75 times the average velocity on the forward stroke:

$$\text{Striking velocity} =$$

$$V_s = \frac{1.75 \times S \times BPM}{12 \times .45 \times 60} = \frac{S \times BPM}{185}$$

The piston weight and rifle-nut weight are generally known, and if it is understood that the piston weight as used in the next equation also includes the weight of the rifle nut, the following expression is valid for the blow energy in the piston:

$$\text{Kinetic energy at blow} = \tfrac{1}{2}\, \frac{W_p}{g} \times V_s^2$$

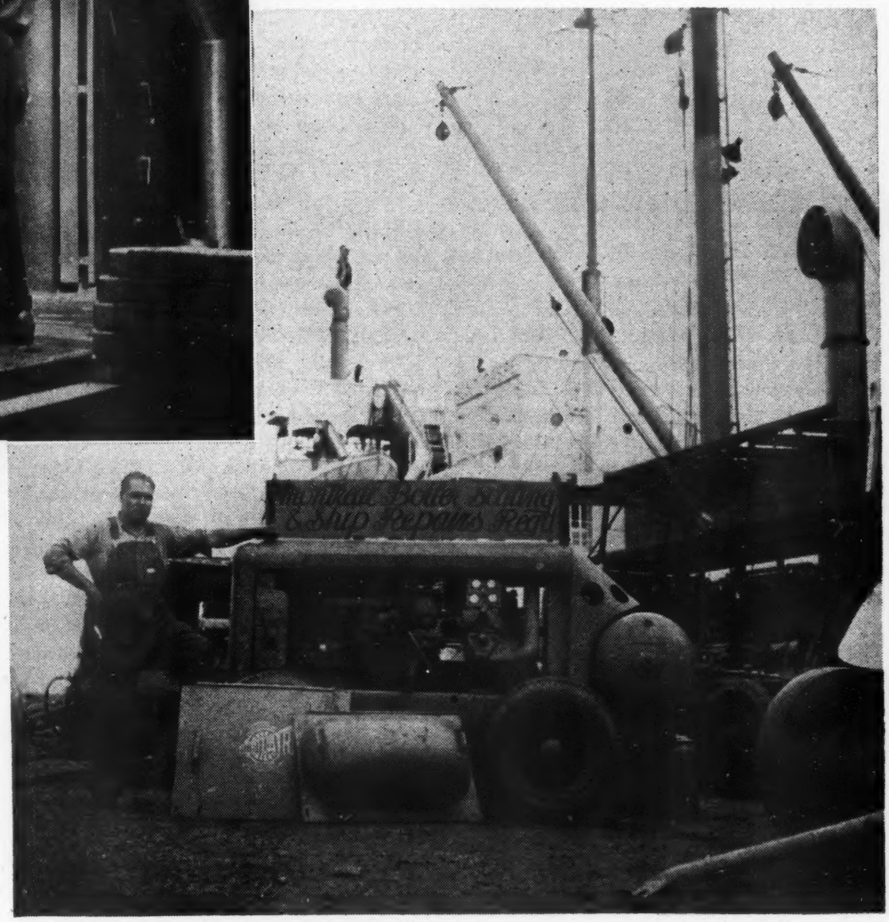
$$= \frac{W_p}{64.4} \times \left(\frac{S \times BPM}{185}\right)^2$$

$$= \frac{W_p}{2.21} \times (S \times BPM)^2 \times 10^{-6} \text{ ft. lbs.}$$

W_p = Weight in pounds of piston and rifle nut
S = Working stroke of piston measured in inches
BPM = Blows per minute struck by the piston

This formula, while not absolutely accurate because of slight variations in the values of the ratios for individual machines, is a much more reliable means of comparing the performances of drills than are the figures obtained from testing machines. It cannot be used with reckless abandon, however, and care must be taken in determining the *BPM* and stroke if best results are to be obtained. It will be found, for instance, that *BPM* is influenced to a considerable extent simply by changing steel lengths. This, of course, is an indication of how the blow energy varies and, in a sense, adjusts itself to the demands placed upon the drill by drilling conditions. Stroke will also show a small change under these conditions.

Air Power Aids Ship Refitting



REFITTING THE "MONT GASPE"
In the top picture a worker is applying aluminum paint to steelwork in a hold with a spray gun. In the other, portable compressors furnishing air for numerous operations are shown on a pier alongside the vessel. The machine in the foreground is a Canadian Ingersoll-Rand 105-cfm. unit.

COMPRESSED air, which was an indispensable medium of power during the war in building fighting and merchant ships, is proving equally valuable in the latter's postwar reconversion and rehabilitation. Hundreds of vessels that were temporarily refitted to carry troops or to meet other special needs during the years of conflict have already been restored to their original condition and service. Numerous others, most of which ran steadily during the war, taking time out only for urgent repairs and maintenance, are undergoing long-overdue overhauls.

Both reconstruction and routine-maintenance programs call for such operations as riveting loose plates, rearranging bulkheads to provide additional cargo space, calking decks, scaling rust, spraying paint, cleaning boiler tubes, etc. All these and others are performed with air-driven tools. The accompanying illustrations give glimpses of a refitting job recently completed in Canada on the S.S. *Mont Gaspe* owned by the Mont Steamship Lines Limited and operated by the Montreal Shipping Company. This vessel, formerly the *Gaspesian Park*, is one of six oceangoing cargo carriers that are now being reconverted by the Mont Lines for Canada's overseas trade.

After the removal of rust from the superstructure and holds with air tools, aluminum paint was sprayed on the steel surfaces. An aluminum-base film is favored for such protective purposes because of its excellent corrosion-resisting qualities and also because it makes for better light in the holds.

Boiler-tube cleaning, which was formerly done largely with steam, is speeded up by recourse to long lances through which powerful jets of compressed air are directed into the confined spaces. Operators prefer the latter medium because it does not subject them to the intense heat incident to steam cleaning.

In addition to the applications mentioned, the work on the *Mont Gaspe* and her sister ships has involved the use of air for operating winches when steam was unavailable, for drilling and reaming holes in metal, and for running wire brushes and grinders. Sump pumps have proved advantageous in dry-dock maintenance work. On one occasion they were utilized for draining oil from a cargo vessel that was being converted into a passenger cruiser. Compressed air for the various services is frequently furnished by portable compressors because they can be either moved about a pier or run on to the deck of a ship, whichever happens to be more convenient.

On her initial trip following reconversion, the *Mont Gaspe* carried a cargo of Canadian exports such as asbestos, nickel, paper, and wood pulp to Mediterranean ports.

The Moles to Honor Two Engineers

WILLIAM A. DURKIN

LT. GEN. RAYMOND A. WHEELER

THIS year's recipients of the annual awards for "outstanding contributions to construction progress" to a member and nonmember of The Moles, New York organization of tunnel drivers and heavy-construction men, will be, respectively, William A. Durkin, president of the Walsh Construction Company, and Lt. Gen. Raymond A. Wheeler, Chief of Engineers, U.S. Army. They were chosen by balloting of the membership and will receive bronze plaques and citations at The Moles' annual dinner in New York on February 4.

Mr. Durkin rose to the head of one of the world's largest contracting firms from a humble beginning as waterboy, at the age of thirteen, for his two roadbuilding contractor uncles, Fitzpatrick Bros., of Brazil, Ind. He was born on a farm in Park County, Ind., on March 6, 1885, the son of Irish immigrants. He attended public school for a few years, quitting to take the waterboy job to assist his widowed mother. After serving in turn as laborer, teamster, and timekeeper, he became a foreman at the age of sixteen. The next few years he spent the summers at roadbuilding and the winters working in nearby coal mines, meanwhile taking a correspondence course in civil engineering.

In 1906, when he was 21, he entered the employ of the New York Central Railroad as a chainman in a surveying crew working between Indianapolis and Terre Haute, Ind. Having advanced to instrument man, he transferred, in 1909, to the Pennsylvania Railroad, where he became chief of a construction party between Terre Haute and St. Louis, Mo. A year later he joined the Frisco Lines at Springfield, Mo., and after a brief period spent in bridge building rejoined the New York Central forces as resident engineer of its Big Four division at Pendleton, Ind., and Sharonville, Ohio.

In those days the Walsh Construction Company was primarily engaged in railroad construction, and young Durkin affiliated himself with it in 1912 as a foreman. After advancing to superintendent and then general superintendent, he was elected a vice-president in 1924 and made his headquarters in Indianapolis until 1938, when he went to New York to direct his company's contracts for driving the $23,500,000 Queens-Midtown Vehicular Tunnel, a large compressed-air job, and the building of two sections of the Delaware River Aqueduct for New York City's water supply.

About 25 years ago the Walsh organization began expanding the scope of its activities to include fields other than railroad construction and now operates throughout the country, with principal offices in New York, Chicago, Davenport (Iowa), and San Francisco. It has executed contracts on some of the nation's largest engineering works, including the driving of four 33-foot-diameter diversion tunnels at Fort Peck Dam in Montana and three tunnel sections on the Colorado River Aqueduct. With other contractors it reared the initial portion of Grand Coulee Dam in Washington.

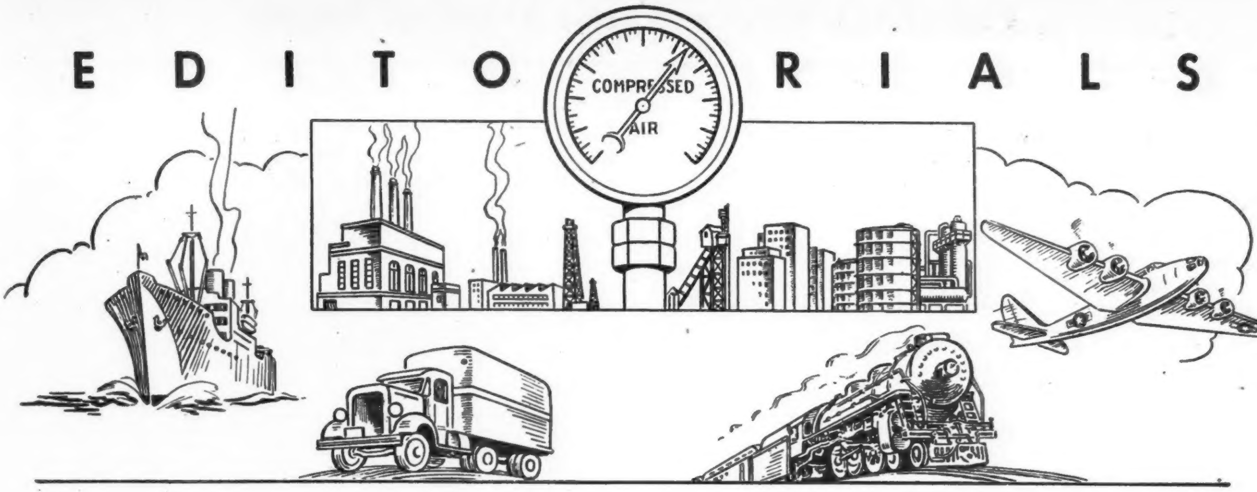
During the war, Walsh forces built Camp Edwards on Cape Cod, Massachusetts, for the Army, the U.S. Army base on the Island of Trinidad, two large dry docks at the Brooklyn, N.Y., Navy Yard and a Navy ammunition storage depot at Red Bank, N.J. In a shipyard established at Providence, R.I., the company turned out scores of cargo and escort vessels for the Navy, and at Jersey City, N.J., it constructed several hundred invasion barges. Recent and current jobs include the building of Electronics Park at Syracuse, N.Y., and an atomic-power laboratory at Schenectady, N.Y., both for General Electric Company; a sheet and tube mill for the Aluminum Company of America at Davenport; a cellulose-acetate plant for Hercules Powder Company at Parlin, N.J.; and coal- and ore-unloading facilities for the New York Central and Baltimore & Ohio railroads at Toledo, Ohio. Contracts have just been received for a diversion tunnel and cofferdam for the Downsville Dam on the East Branch of the Delaware River for New York City's water supply and for a water tunnel for the City of Boston.

General Wheeler, in addition to his strictly military duties, is the director of a multimillion-dollar program of construction that includes river and harbor works and scores of hospitals for war veterans. During the 1947 fiscal year Congress appropriated $298,322,825 for flood control by the Army Corps of Engineers and $116,718,000 for the maintenance and improvement of rivers and harbors. The expenditure of these funds and others is under his administration. The current flood-control program comprises 156 projects in 35 states, of which fifteen each involve an outlay of $5,000,000 or more. In addition, $50,000,000 is to be spent for work on the lower Mississippi River and $1,750,000 on the Sacramento River in California. Thus far Congress has provided $770,000,000 for the building of veterans' hospitals, and contracts have been awarded for 84 institutions.

General Wheeler was born in Peoria, Ill., July 31, 1885. Upon being graduated from the U.S. Military Academy in 1911, he was commissioned a second lieutenant, Corps of Engineers. After serving in Mexico and Hawaii he was assigned to the Isthmian Canal Commission. He was overseas in World War I with the 4th Engineers, taking part in the Aisne-Marne, St. Mihiel, and Meuse-Argonne offensives and, later, entering Germany with the Army of Occupation. His decorations include the Silver Star and Distinguished Service Medal. After duty in Italy with the American Commission to Negotiate Peace, he returned to this country in 1919, subsequently serving as district engineer at Newport, R.I., Wilmington, N.C., and Rock Island, Ill., and as assistant engineer commissioner of the District of Columbia.

During World War II, General Wheeler covered the globe pretty completely. In 1941, as assistant chief of staff, Supply Division, he went to Iran with the Military Supply Commission. Among his later assigments were: Military Commission in Bagdad, India-Burma theater commander, U.S. representative at the Japanese surrender in Singapore, and Southeast Asia commander. At one time or another he was responsible for getting American supplies to Russia, to the British, and to the Chinese forces

EDITORIALS



ADVANCES IN MINING

THE development of mass production, with its attendant economies, has enabled the United States to sell numerous manufactured articles in world markets and still pay wages that are beyond the reach of other nations. In a somewhat similar manner, the mining of low-grade ore deposits is being carried on profitably in some of our western states. In Utah, the average value of each ton of ore produced is only $3.10. In Arizona it is $3.81, and in Nevada $4.45. These low averages are attributable to the fact that in those states Nature has accumulated large concentrations of copper ores at or near the ground surface where they can be extracted from open pits with power shovels and railroad cars.

Not all mines are in this class, however. They are, in fact, exceptional, and most of them are of the underground type where daily output is of necessity relatively low. With labor scarce and wages high, the cutting of costs calls for the exercise of all the talents management can command. Good organization of the work and increased mechanization are the principal tools available for boosting production per man-shift. Mechanization adds materially to capital investment, and thus the trend is towards putting more and more mines in the category of "big business."

Mining methods have changed so much in recent decades that old-time miners would hardly believe what they saw if they were to go underground. The term "mucker" formerly meant a man with a shovel, and he had a real back-breaking job. Nowadays the mines don't buy many hand shovels. Most loading is done with mechanical shovels or with hoist-powered scrapers that have the added virtue of being capable of moving broken material considerable distances, as well as putting it in loading chutes or directly into cars.

Drill runners used to labor hard to set up heavy drifter machines, which had to be hand-cranked. Hundreds of pounds of drill steel had to be moved to and fro between working areas and sharpener shops. Now much of the drilling is done from jumbos that move easily along railroad tracks. The drills are power-fed into the rock face, and the rate of penetration is ever on the increase. A detachable bit that weighs less than a pound is the cutting medium, and only a few rods of varying lengths that make infrequent trips to the blacksmith shop are required at each drilling place. Similar improvements and innovations are found throughout the workings themselves. Once considered an arduous and somewhat hazardous occupation, the mining industry is today almost as mechanized as a factory and, on well-run properties, accidents are rare.

Large mines naturally lead in the research that continually reduces production costs and eases the lot of the worker. However, what they learn is quickly passed on to the small operator and he, too, benefits. Furthermore, big properties often help the little ones by making their processing facilities available on liberal terms.

BRITAIN FIGHTS BACK

OUR British cousins are beginning to show signs of making an economic comeback. Apparently convinced that they must help themselves if they are to regain a fair proportion of what they have lost, they have recently taken a hitch in their belts and gone to work. Heartening is the news that more coal is being mined, enough more in fact to permit exporting 80,000 tons a week and increasing the domestic supply by 20,000 tons weekly. In the old days, coal was important in Britain's world trade. It brought her money with which to buy many of the things she needed. It was the one basic natural resource that she could exchange for the numerous raw materials required to manufacture the goods she exported to the far corners of the earth.

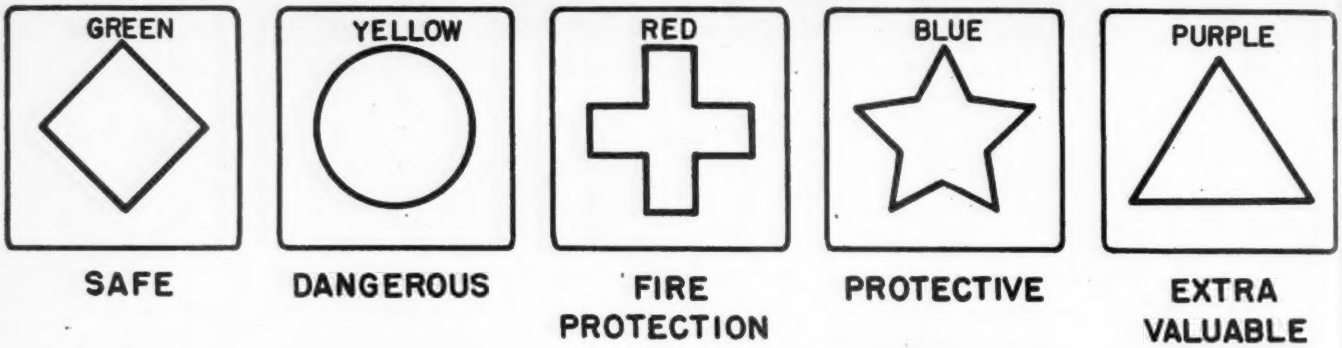
John Bull has taken some hard blows on the chin in the past ten years. His stamina has evoked universal admiration. Wearied by war, he was knocked to his haunches by a political upheaval and the human unrest that has engulfed virtually every nation. It seemed for a time that the muddling for which he is known would lead him to utter chaos; but, apparently, he is, as he has always done, getting back on the road to clear thinking.

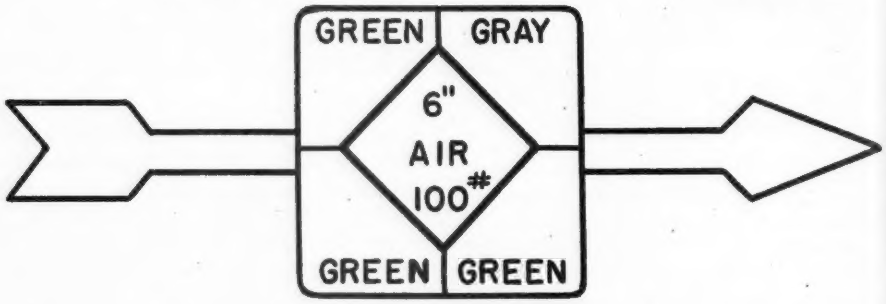
The turning point came when British miners, along with textile workers, agreed to put in longer hours than they had. This increased work-week is still less than 40 hours, but it has made a big difference. With the same machinery and an equal number of men, coal production is at its maximum since 1940. Steel and textile output in the past three months likewise is up 10 percent, and the railroads are moving freight faster than they were.

Obviously there has been a psychological change due in part, perhaps, to the granting of wage increases. The will to work is returning. Men are answering the long-unheeded appeals of the government and of labor-union leaders to produce more, lest the nation's head be submerged. We even read that a Welsh miner set a reputed new world record by digging 188 long tons of coal by hand in a work-week of 37½ hours. There is word, also, of volunteers pitching in week-ends to help unload freight cars in order that they might be reloaded sooner.

There is a saying that the British lose many battles but win most of their wars. Perhaps they are only showing us that they fight their economic conflicts in the same way. In any event, cheering reports are coming from across the Atlantic. British stamina is still in for a good test, but if the rank and file of her citizens keep thinking along present lines, then the ground that has been lost will most likely be regained. In the present battle against totalitarianism, the world can well use a strong Great Britain.

Pipe-Line Markers that Meet all Needs





IDENTIFICATION SYSTEM
At the top are pictured the different symbols used by Mr. Lancaster in combination with the colors recommended by the National Safety Council for marking pipe lines in industrial plants. A compressed-air line is distinguished by a square-shaped symbol (right) and a green and gray background. The first is the primary color and denotes that the fluid carried is of a safe nature, while the secondary gray identifies it as compressed air.

MARKINGS for pipe lines to designate their contents vary widely in industrial plants. Many concerns have their own systems, while others follow the color-coding plan recommended by the National Safety Council and the American Society of Mechanical Engineers. An interesting variation of the latter has been devised by John B. Lancaster of Philadelphia, Pa. By the addition of symbols to the recommended color code, his system enables persons who are color blind to determine the contents of a line as easily as do persons who are endowed with normal color perception.

Colors used in the standard safety code are as follows: green for contents of a safe nature; yellow for dangerous fluids; red for fire-fighting systems; blue for piping to protective controls on machinery; and purple to distinguish lines carrying valuable gases or liquids. In the modified code, the contents are variously designated by a square, a circle, a cross, a star, or a triangle, with the corresponding color forming the background for the design. The space enclosed by the symbol proper is white and serves to record the size of the piping, the contents, and the approximate pressure. An arrow in the background shows the direction of flow. The symbol, background, and arrow are made up in the form of a decalcomania, which can be easily and quickly transferred.

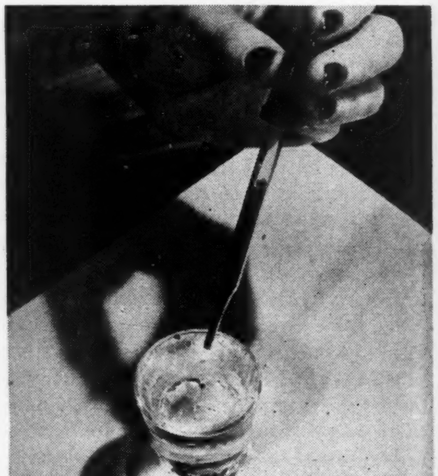
According to the designer, further modification of the system is possible by dividing the background into four equal parts and coating one or more of them with a second color to represent the fluid in the piping. The choice of such secondary colors would devolve upon the individual plant and would necessitate the posting of explanatory charts at strategic locations. Innumerable color combinations are possible by this system, and the inventor claims that operators, whether color blind or not, are soon able to tell the contents of a pipe line at a glance.

Circus Cannon Operated by Compressed Air

THE famous Roy Rogers Thrill Circus features the only female cannonball in history. And according to Edmondo Zacchini, who operates the cannon, the device is fired by compressed air at a pressure of around 200 psi., which is pumped into a compression chamber at the base of the gun.

Victoria Zacchini, Edmondo's daughter, is the cannonball—the first woman ever used in this type of entertainment. Edmondo, who invented the air cannon, regulates the amount of the charge—and, incidentally, the distance Victoria will fly through the air—by a pressure gauge. He presses an electric trigger, causing a piston to shoot forward and to project the human cannonball at tremendous speed. A large firecracker goes off at the same time to give the effect of an explosion and a sense of realism. In the meanwhile, with her muscles tensed, Victoria crouches on an aluminum form that is padded with a layer of felt 2 inches thick. She wears heavy overalls as a protection against burns through friction in her swift course through the gun barrel.

Back in 1922, on the Isle of Malta, the birthplace of the Zacchinis, Edmondo first tried shooting human beings out of a cannon. Regular military models weren't practical, of course, so he tried making one himself from aluminum. Soon he tried compressed air as the propulsive medium, with heartening results; and so far, in more than 2000 shots, Victoria has never even been scratched. When asked if she was afraid at times, she replied in a matter-of fact tone: "Why should I be, wasn't I born in the circus ring?"



STEEL BALLS THAT FLOAT
These steel balls are so tiny that they float when squeezed from a medicine dropper into a jigger of water. They are only 1/25 inch in diameter, and the dropper contains several hundred of them. They are made by SKF Industries, Inc., for ball-point pens and delicate measuring instruments.

This and That

Radiant Heat for Highway

A 400-foot length of concrete highway with an 8 percent grade at Klamath Falls, Oreg., has been protected against ice formation and consequent skidding of motor cars by embedding in it a system of piping through which a warm fluid is circulated. Grids of ¾-inch pipe have been laid on 18-inch centers in 60-foot panels, with each panel connected to a 2-inch line paralleling the highway. This closed circuit is filled with water containing an antifreeze solution and is warmed by transfer of heat from the discharge of a nearby hot spring. Whenever the temperature drops to the freezing point, a thermostatic control automatically starts a pump to circulate the fluid in the closed circuit. At the same time, a second pump begins circulating water from the spring through the heat-transfer unit. Both are shut down by the thermostat when the air temperature rises above the freezing point. This is the second application of the winterproofing of highways by radiant heat that has been reported. The first installation was put in service in Belmont, Mass., last winter.

* * *

Many New Uses for Aluminum

In a year-end review, Reynolds Metals Company of Louisville, Ky., recounts an astonishing growth in the use of aluminum and forecasts even greater diversification and application in the future. Measured by the number of persons it employs, the aluminum industry advanced from fiftieth place in the rank of American industries in 1940 to tenth in 1947. Each new automobile now contains between 20 and 30 pounds of aluminum, compared with 10 pounds a few years ago and with 100 pounds predicted in the near future. More than half the states are said to be using or planning to use aluminum motor-car license plates, which are lighter than steel and require less painting. Production of aluminum truck and trailer bodies has now reached several thousand units a year, with savings in weight up to 3100 pounds for 30-foot structures. The fastest-growing demand for the metal is in the fabrication of heating and ventilating ducts, with a tenfold increase in 1947. Household utensils—first large-scale popular outlet for aluminum—now stand third in the long list of applications. Greater output has brought a reduction of 30 percent in the base price of aluminum since 1939, compared with an advance of 100 percent in the composite price of other metals. Classed as under development for 1948 are a 10-inch aluminum pipe line 1000 miles long, aluminum light-bulb bases by the million, basement fuel-oil storage tanks for the home, as well as running boards, fender skirts, scuff plates, and many other parts and accessories for automobiles.

* * *

Pacific Sardine Mystery

Normally a multimillion-dollar-a-year enterprise, the sardine industry of the Pacific Coast has shrunk to unprofitable proportions. Reason: the hordes of tiny fish that formerly inhabited California waters have largely disappeared to nobody knows where. The 1946 catch was low, but it was good by comparison with that of 1947. The San Francisco fleet caught only 135 tons up to November 20, last. Farther south, the fleets fared better, but their takes also show alarming declines. As to the cause, some say there has been too much fishing, others think something is killing the baby sardines before they can attain maturity. It has been noticed that fish are plentiful when the ocean salinity is high, but that they decrease as the salt content drops. This prompts some observers to advance the theory that sardines migrate to the more saline ocean areas. If this is so, fishermen may have to carry chemical kits to locate their quarry, or even carry along huge supplies of salt to season the water to the sardines' liking. To fathom the mystery, the California Fish and Game Commission is seeking a $125,000 state appropriation to outfit a ship as a laboratory that can cruise up and down the coast to make investigations.

* * *

Steel Mill to Use Oil for Fuel

A new steel mill to be erected near the Assuan Dam in Egypt will, it is reported, use petroleum for fuel instead of the conventional coal and coke. A new reduction process that makes this possible is said to have been developed by H. A. Brassert, an American consulting engineer. A pilot plant is now operating at Minneapolis, Minn., and Egyptian ores are being shipped there for testing. Rich iron-ore deposits exist near Assuan, and an ample supply of petroleum is available from the Near East, but there is no coal within economical transportation distance. It is reported that the mill will

INTERNATIONAL NEWS PHOTO

DREDGING WITH COMPRESSED GASES

The British are finding other uses for power jets besides driving airplanes. This picture shows one mounted on a barge and directing high-velocity gases against a river bottom to loosen mud, which is then carried away by water currents. This method is employed instead of dredging to deepen waterways in ship channels and adjacent to piers. The man in the crane bucket at the upper left is a photographer. During the unusually heavy snowstorms in England last winter, a Rolls-Royce jet-type airplane engine was mounted on the front of a locomotive to blow drifted snow from the tracks of the London, Midland & Scottish Railway Company. Another novel application of engines of this kind is found in the works of Rolls-Royce and of associated companies, where several of them have been adapted for burning oil under steam boilers.

have an initial daily capacity of 600 tons of steel products and that its output will supply the needs of the Near East.

* * *

Mine Flies Ore

Numerous mines in inaccessible places have flown in equipment, and a few, such as the radium producer on Great Bear Lake, Canada, ship concentrate by air. But it's the exceptional property which has ore rich enough to warrant freighting it out by airplane. In that class, however, is the Bear Basin Mine in the Cascade Mountains of Washington. It operates a helicopter to fly its output, 200 pounds each trip, to North Bend, 26 miles distant. From there it is trucked to a smelter at Tacoma. The ore contains silver, gold, copper, lead, and molybdenum.

* * *

"He always waits until he gets here before he tells his wife off."

Industrial Production Milestones

Evidence of the might of mass-production techniques that characterize the American industrial scheme is found in recent announcements by two manufacturers of widely differing consumer goods. On November 11, The Goodyear Tire & Rubber Company turned out, at Akron, Ohio, its 425,000,000th penumatic tire for motor vehicles. It was also the 25,000,000th one produced in a period of ten months and ten days, a volume that had never been reached in less than twelve months. The company began making motor-vehicle tires in 1902, and required 17½ years to turn out its first lot of 25,000,000.

Last month the Maytag Company, of Newton, Iowa, produced its 5,000,000th washing machine. The firm was organized in 1938 by four men with a capital of $2400. It started out making farm equipment, and built its first washer, a hand-operated model, in 1907. The first power unit driven by a belt from an engine was introduced in 1909. Production reached one million by 1927, but since then the company has turned out 4,000,000 though it made none during the war.

* * *

Concreting from the Top Down

In the construction of multistory steel-frame buildings, concrete floors have traditionally been laid by starting with the lowest and working upward progressively. Under a new system originated by Manuel Gonzales, a young civil engineer of Mexico City, this practice is reversed. The scheme is not applicable to the two upper floors, and in the case of a 20-story structure pouring starts at the eighteenth. Forms are suspended from the top-floor framework on ½-inch steel rods, there being an assembly for each bay with about 20 rods per bay.

After work on a bay has been completed, all the rods but one at each corner are detached. The corner rods, together with the forms supported by them, are then lowered simultaneously one floor by chain hoists. Next, the intermediate rods are restored. In their new positions, the rods are suspended from the nineteenth-story framework, with the forms on the seventeenth floor. This plan is followed to allow time for the intervening concrete to gain strength. As the interior rods must necessarily pass through the newly poured floor, wood "cones" are set in it to provide openings that are subsequently filled. This procedure is repeated until the ground floor has been poured.

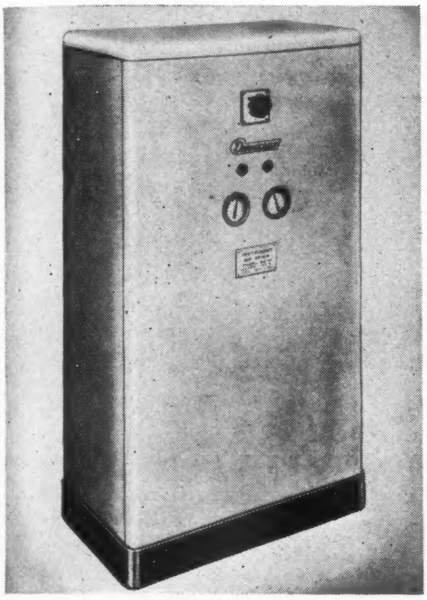
By this system the same forms are used over and over, instead of destroying and rebuilding them floor after floor. The result is a reduction in both materials and labor costs; in the case of the latter, a saving of as much as 40 percent is claimed. After the highest floor has been placed, workmen and fresh concrete are protected and operations can proceed regardless of weather. It is said that a floor consisting of 30 bays can be concreted and stripped of forms in a week.

In this country the new method is called the "D.C.," the initials of *descimbrar cimbrando*, Spanish for strip off and reërect. Following its successful use on ten buildings erected in Mexico since 1945, the inventor has licensed an American concern to promote it in the United States. It was tried out recently in a limited way on a new structure in Houston, Tex., and the contractor is reported to have been pleased with its possibilities.

"I've got a sneaking suspicion he's related to the warden."

Industrial Notes

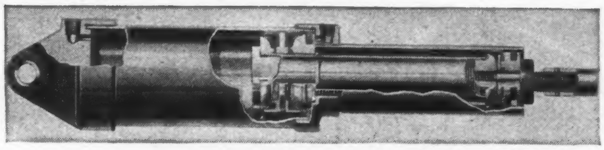
Air-operated instruments, obviously, perform best when the air supply is clean and dry and free of oil and water vapor. Dehydraire Corporation has recently developed a new line of instrument air driers with a capacity of 12½ to 250 cfm. at 100 psi. pressure and 70°F. that will, it is claimed, handle the air supply for 25 to 500 instrument installations or for other services. The air leaving the Dehydraire has a final dew point as low as −50°, which is below any temperature recorded in this country, thus insuring absolute dryness regardless of weather conditions. Standard units are being built for either single or polyphase reactivation or for steam



CABINET MODEL

reactivation where steam at 100 pounds pressure or more is available. Those for servicing 25 to 100 instruments are enclosed cabinet models, while those for 150 to 500 instruments are of the open-tower type with front operating panel. All are designed for either manual or automatic reversal on an 8-hour cycle. For refineries or other hazardous locations, all electrical equipment is of Group D, explosion-proof construction. When used in conjunction with refrigeration, especially in tropical climates, considerable increase in capacity is obtained.

The Joyce-Cridland Company has announced the production of its latest model air-motor-driven jack for railroad passenger-car and locomotive repair service. Known as the Joyce Air Motor Jack, it is of the ball-bearing, geared-screw type and is available in sizes ranging from 50 to 100 tons capacity. The height varies from 26 to 44 inches and the weight from 425 to 620 pounds. The vertical lift for the various models ranges from 13¾ to 30 inches. Powered by an Ingersoll-Rand JC-55 heavy-duty rotary air motor, the jack operates on air at a pressure of 90 psi. A motor of the piston type is optional. Clutches and brakes have been eliminated, and the load is lowered by reversing the motor. Automatic shut-off valves are located at both the upper and lower ends of the ram. A muffler on the side deflects the exhaust air to the ground so that oil or water cannot accumulate on the machine. The jack is mounted on 10-inch pneumatic-tired wheels and is equipped with a folding handle. One man can easily trundle and place the machine in position and can control a pair of them by means of a Y valve in the air line. Features claimed for the jack include speed of operation, mobility, and efficiency in handling heavy loads. It is claimed that by using compressed air in place of manpower the machine saves nine-tenths of the time ordinarily required in jacking a load by hand. Another advantage is the greater safety provided by automatic cutoff valves and by the fact that the jack cannot slip or drop its load. Although designed primarily for roundhouse use, it has been found suitable for heavy construction work such as culvert pushing and bridge support.

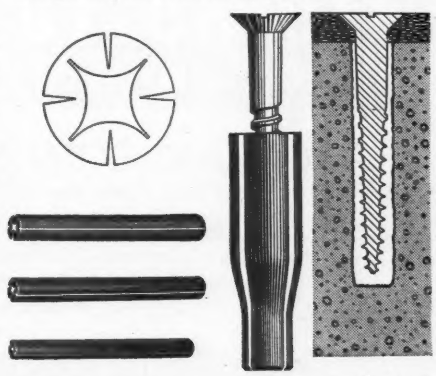


Treating water with Pentrate is said to make it wetter, paradoxical as that may seem, and therefore an effective extinguisher especially of deep-seated smoldering fires. It is compounded of chemical ingredients by the American-La France-Foamite Corporation, and as little as 1 percent in water increases the latter's penetrating and spreading qualities. Ordinary water has considerable surface tension, causing a drop to retain its shape, while a globule of Pentrate-treated water will flow in all directions, thus covering a larger area. It is no more injurious to wood and metals, it is claimed, than water itself, and can be used with salt water or calcium-chloride solutions.

National Pneumatic Company has announced a new line of differential air engines or cylinders for general industrial use. The application of the differential principle in a unit of this type is of advantage in that positive air power is obtained in both directions, thus putting the "in" and the "out" stroke to work. With compressed air at 100 psi. pressure, the power of the standard-size units ranges from 100 to 1335 pounds on the in stroke and from 105 to 1070 pounds on the out stroke, except when two air lines are used. Then the range in the case of the latter is 205-2400 pounds. But one air line is required, thus simplifying control and making the engines especially suitable for multiple hook-ups or where controls are located at remote points. Other features include a nonlocking piston rod, automatically adjusted air seals, and elimination of stuffing boxes. Three-, 6-, and 9-inch-stroke units are obtainable with an air valve of the push-button, hand-lever, or foot-operated type or, for remote control, with a solenoid valve.

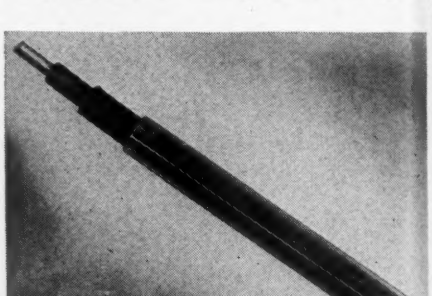
Measuring but 7⅞ inches, including an eyebolt top and bottom, the Dyna-Switch recently announced by W.C. Dillon & Company, Inc., is designed to serve as an adjunct to overhead cranes and chain or cable hoists. Interposed between the overhead rail and hoist or between the hoist chain and hook, or suspended directly from the hook in the case of a crane, it weighs loads up to 10,000 pounds and flashes a warning light, rings a bell, or cuts out the hoist motor in the event of overload. This little monitor of special-alloy tool steel is made in different models ranging in capacity from 0-100 pounds to 0-10,000 pounds and having indicators with 1- and 100-pound divisions. It is claimed that the switch always returns to true zero and withstands accidental overloads considerably in excess of the hoist limit.

Something basically new in anchors for wood or lag screws is being offered by Holub Industries, Inc., Sycamore, Ill., under the name Sandscott Plastic Expanding Anchor. It is made slightly larger in diameter than the hole into which it is to be driven and has overlapping internal and external slits that cause the anchor to expand concertina-like when the screw enters, thus insuring a high degree of holding power, as proved



by pull-out tests. The plastic used is tough but pliable; has a tensile strength of 5000 psi.; is resistant to temperatures from −78 to +180 F.; and is not affected by acids, water, etc. Threads cut into it by the screw are said to be perfect, permitting the latter to be screwed in and out without loss of holding power. The anchors are now available in seven popular sizes and can be readily cut to length with a knife, saw, or pliers. Free samples may be obtained upon request.

Utility companies and home owners may be interested in a guard that has been produced by Martin M. Stekert as a protection for electric wires especially at friction points. Maintenance crewmen can snap it on quickly and do not have to lop off tree branches that rub against transmission lines. Made of shatterproof, water-repellent, transpar-



ent plastic, it is said to eliminate arcing and burning due to current leakage, to prevent the fraying of wire insulation, and to remain stable and resilient at all temperatures. Called Snapon Wire Guard, it comes in 6-foot sections that may be overlapped and interlocked or cut into shorter lengths. At present it is being molded for No. 4 and No. 6 wire. It fits tight to keep out water and adds little to the over-all diameter of a line.

Rubber strips are said to be superior to wooden strips for giving concrete surfaces decorative grooves or beveled edges. The material is made by the United States Rubber Company in varying shapes and sizes and is attached inside the forms by a waterproof adhesive. Rubber, unlike wood, can be used repeatedly and produces a smooth finish free from blemishes.

Storage batteries for passenger cars that will last three times as long as those now in service in the United States are in prospect for the motorist, but not for another year or two, according to a recent press report. Instead of the customary lead plates and acid solution, the new type has nickel-plated, cadmium-steel cells immersed in an alkaline bath. Strictly speaking, the battery is not new: it has been used in Europe for several years and was first put in

production in this country by the Nickel Cadmium Battery Corporation for the Government during the war. Present output is confined to large, heavy units for diesel-engine starting motors and for commercial vehicles such as trucks and buses. A smaller, lighter type is being developed and will necessitate changes in battery-servicing methods.

Promotion of mine health and safety is the primary purpose of a unique dispenser and cartridge containing a highly concentrated solidified wetting substance known as Compound M. The dispenser or automatic flow proportioner is interposed in a water line, and the pressure of the water does the spraying. The cartridge, which is 8 inches long and 3½ inches in diameter, dissolves in proportion to the water passing over it and will treat approximately 1000 gallons. Replacement is easily made, and a device on the dispenser shuts off the latter if the operator forgets to renew the spent cartridge. The proportioner is 19 inches long and 4½ inches in diameter and can be fastened to a cutting or loading machine, rotary dump, or tipple, or elsewhere in a colliery, as well as in metal mines, foundries, and industries where dust hazards exist. The manufacturer, who is offering his equipment on a money-back guarantee, claims that it reduces dust in air and passageways as much as 80 percent and that it cuts water consumption by 75 percent, to that extent promoting the health of workers, preventing corrosion of metal surfaces, and lessening the danger of explosions.

A direct-operated, solenoid, high-vacuum valve requiring no pilot or other medium of control has been introduced by Airmatic Valve, Inc. It operates on 110-volt direct current, is of poppet design, and has corrosion-resistant internal parts. A resilient synthetic rubber

type of seating provides a positive leakproof seal. The valve is so designed that no packing is needed—a factor that makes for long life. Laboratory tests and service experience show the average leakage to be only three microns. The valve brings fully automatic control much nearer in industries where high vacuum is used or may be adapted to operate equipment.